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# Identification of economic impediments to utilization of Mexico's idle lands and policy implications for the ejido and private sectors

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# Identification of economic impediments to utilization of Mexico's idle lands and policy implications for the ejido and private sectors

by

David Eugene Hansen

A Dissertation Submitted to the

Graduate Faculty in Partial Fulfillment of

The Requirements for the Degree of

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# I. INTRODUCTION

## A. Nature and Problem of Idle Lands

Throughout the recent history of Mexico, the ownership of land and its utilization has played a turbulent and central role. Land problems have aroused the emotions of the peasants and the eloquence of the politicians.

Great amounts of resources have been expended in the opening of new areas to cultivation in the last 20 years, especially through the development of irrigation works. These works have received over 80 percent of the total public investment in agriculture. From 1949-51 to 1962-64, one and one half million hectares were brought into cultivation through irrigation projects. This represented about 30 percent of the total expansion in cultivable land area for the period[1]. According to the Ministry of Hydraulic Resources plans, total irrigated area will have increased from 4 million to 5.9 million hectares between 1962 and 1985[2].

Against the background of the historical importance of land in Mexico's development and the great deal of attention which has been directed towards land utilization, ownership and the opening up of new cultivable and irrigable areas--it is most surprising that there appears

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[1]Venezian, Eduardo and Gamble, William K. El desarrollo de la agricultura mexicana: estructura y crecimiento de 1960 a 1965. Serie de Investigaciones Económico Agrícolas, Centro de Economía Agrícola, Escuela Nacional de Agricultura. Chapingo, México. 1968. p. 113.

[2]Shafer, Robert Jones. Mexico: Mutual adjustment planning. National Planning Series. no. 4. Syracuse University Press. 1966. p. 91.

in the Mexican Agricultural Census a large category of "tierra en descanso", literally translated as "land at rest". Furthermore, this category has appeared in each census since the inception of the Agricultural Census in 1930. Yet more surprising than the existence and magnitude of the idle land reported, is the apparent lack of awareness and lack of interest in pursuing studies to explain the reasons for this idle land and the possibilities of utilizing this seemingly immense resource potential.

The present study treats only one small part of the larger problem of land utilization in Mexico. It is a study of the idle land category as it appears in the Mexican Agricultural Census. It excludes other problems of land utilization such as single cropping of short season crops when longer season crops or double and triple cropping would be feasible and more remunerative--a practice which results in what might be called "seasonally idle land". Also excluded from the scope of this study are changes in cropping schemes which would encourage higher use of land and the problem of more efficient use of scarce irrigation resources. For, by definition, in order to be classified as idle land, one of the criteria which must be met is that the land be capable of cultivation yet left unused for an entire agricultural year[3].

## B. Terminology of Land Use Classification

Throughout this study the "tierra en descanso" land classification category shall be termed "idle land". A more correct translation for

[3]The agricultural year used in the 1960 Mexican Agricultural Census runs from May 1, 1959 to April 30, 1960.

idle land would be "tierra ociosa", literally translated as idle. However, it appears the census has chosen to use "en descanso" (at rest) rather than "ociosa" (idle) in order to avoid biases in reporting. These biases could arise from the strong legal sanctions against leaving land "ociosa", whereas leaving land "en descanso" is acceptable[4]. In practice the two become very nearly, if not completely, the same thing.

To evaluate the possible importance of the idle land category, it is necessary to synthesize the Mexican Agricultural Census land classification definitions from their various sources in order to understand what is excluded and what is properly included under idle land.

Land classification categories in the Mexican Agricultural Census are somewhat imprecisely defined. For example, when presented with specific hypothetical cases to classify, variations were found in the classification decided upon by the officials working at the Census office, or the case in question depended on the subjective judgment of the enumerator in the field.

According to various definitions found in the Mexican Agricultural Census Resume, the census questionnaires, and the enumerator instruction booklets, total agricultural land area can be divided into three categories[5]:

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[4]See for example: Leyes y Códigos de México. Código Agrario y Leyes Complementarias. Ley de tierras ociosas. Art. 1, 2, 3 and 7. 17 ed. Editorial Porrúa, S.A. México. 1968. pp. 171-176.

[5]The material in this section is based on a composite of information and explanations found in the (footnote continued on following page)

1) Cultivable lands (tierras de labor); "Land with the physical characteristics which enable it to be considered feasible for seeding, cultivating and harvesting of vegetal products when accompanied by the necessary agricultural labors". It is within this category that the subcategory of idle land is found;

2) Flat land pastures;

3) Hillside pastures;

4) Forest composed predominately of harvestable specie (pine, cedar, etc.);

5) Forests composed predominately of non-harvestable specie (chaparral, mezquite, etc.);

6) Non-cultivated but productive lands; Lands with plant species of collectable fruits, roots, etc., where labor is applied only in the collecting of these products (nopal, wild fruits, etc.);

7) Agriculturally unproductive lands (rocks, swamp, salty land, roads, limestone subsurface, etc.).

There exists an additional classification under which the categories

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(continued from preceding page) following sources: Secretaría de Industria y Comercio, Dirección General de Estadística. Cuarto Censo Nacional Ejidal. Cuestionario para predios ejidales. México. 1960.; ________ Cuarto Censo Nacional Agrícola Ganadero. Cuestionario para predios no ejidales mayores de cinco hectáreas. México. 1960.; ________Cuarto Censo Nacional Agrícola Ganadero. Cuestionario para predios no ejidales de cinco hectáreas o menos. México. 1960.; ________Cuarto Censo Nacional Agrícola-Ganadero. Instructivo para llenar los cuestionarios de predios agrícolas no ejidales. México. 1960.; ________Instructivo para llenar el cuestionario de predios ejidales. México. 1960.; ________Cuarto Censos Agrícola-Ganadero y Ejidal. 1960. Resumen general. Mexico. 1965.; and ________Cuarto Censos Agrícola, Ganadero y Ejidal. 1960. (Resúmenes estatales). México. 1965.

(2) through (7) are evaluated as to the possibility of their being opened to cultivation "easily at feasible costs". This is termed "land susceptible to cultivation".

The cultivable land portion is further sub-classified into:

1) Seasonal lands (temporal); This land must receive rainfall in order to sustain a crop.

2) Wet lands (de jugo o humedad); These lands receive and conserve sufficient moisture so that they are capable of raising crops without being dependent upon irrigation.

3) Irrigated lands; These lands receive sufficient water by artificial means (dams, wells, etc.) to sustain a crop.

4) Lands planted in fruit crops, plantations or agaves; This classification is further subdivided into the above categories of seasonal, wet, or irrigated lands.

In order to qualify as tillable land, the area must have been seeded, cultivated, worked or improved for one or more of the last five years. Furthermore, if the area is not being cultivated during the census year, it must be possible to bring it into cultivation anew in "an easy manner".

The cultivable lands category is also classified on the basis of use as follows:

1) That area harvested during the year;

2) That area seeded but not yet harvested;

3) That area seeded but not harvested due to crop loss from ice, hail, drought, floods, disease, plagues, etc.;

4) That area dedicated to fruits, plantations and agaves;

5) That area left idle the entire year.

In the 1960 Mexican Agricultural Census, a new sub-classification was added to earlier censuses to try and examine further the idle land category. Idle land was divided into that left idle: (a) for rotational reasons; (b) for other motives. The explanation which accompanies the new classification of idle land for rotational reasons states: "There is the custom in the rural areas, which hits close to the correct solution, of leaving the cultivable land idle periodically, that is, they are not cultivated so that during this idle period they can recuperate fertility and other characteristics which were lost during the last cultivation, circumstances which lead to their being left idle one year and worked two consecutive years, or left idle every other year. This is called rotation in their usage"[6].

However, it should be noted that this attempt to clarify the idle lands problem was rather unsuccessful, since 84 percent of the total idle land remained in the "for other motives" category for which no explanation is offered.

An additional land classification category found in the Mexican Agricultural Census is one differentiating between the land surface which is exploited (used) and that which is not exploited. The unexploited cultivable land surface is defined as that which was not cultivated in

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[6] Instructivo para llenar los cuestionarios de predios agrícolas no ejidales, _op. cit._, p. 16.

the 1959-1960 agricultural year, nor from which any product was received--a situation proven by there having been no livestock, fowl or beehives on this land[7]. It was found that the unexploited tillable land surface figures were exactly equal to the idle land figures reported.

From this series of standards and definitions, what is (or should be) included in and excluded from the idle land category is derived. Thus, idle land is land which is cultivable as shown by its having been cultivated within the last five years. Idle land would not be pasture lands, forests or brush, nor would it be unproductive land. It would not be land which is possible to open to cultivation but as yet unopened. According to the definitions, idle land would not be irrigable land left idle because of insufficient irrigation water. The idle land would not have been seeded in any way during the year, nor would it have been used for pasturing of livestock or even as a resting place for beehives!

## C. Objectives of the Study

The objectives which this study strives to fulfill are:

1) Determination of the extent to which idle land, as defined above, is a strategic problem within the agricultural sector of Mexico;

2) Identification of the reasons for which land is left idle, including an examination of possible differences due to land tenure systems;

3) Assessment of relative importance of the reasons identified. If

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[7] Cuarto Censos Agrícola-Ganadero y Ejidal. 1960. Resumen general, _op. cit._, p. XII.

a problem is found to exist, and if reasons for its existence are identified, it is necessary to determine some ordering of the importance of the identified variables to understand and correct the problem;

4) Formulation of possible policy alternatives which would remove or mitigate those elements most responsible for idle lands;

5) Suggestion of additional research needed to understand the idle land problem and better utilize these resources;

6) Evaluation of Mexican Agricultural Census data as to its usefulness in conducting economic research.

## D. Procedures for Carrying out Objectives

Before selecting the procedures used to pursue the objectives stated above, hypotheses are formulated to suggest explanations for the phenomena singled out for study[8]. For valid tests of these hypotheses to be conducted, certain empirical information is required. Finally, an explicit statement should be made of some of the basic assumptions which underlie the study, since these assumptions influence the directions the research takes and hence the appropriateness of the procedures chosen.

In the absence of certain underlying assumptions, the objectives set forth for study become irrelevant. It must be assumed that Mexico desires economic development[9]. Furthermore, where attractive alternatives can be

[8] A more detailed development and statement of the hypotheses to be tested in order to fulfill objectives 1, 2, and 3 of the study is presented in Chapter IV.

[9] For the purposes of this study, economic development is viewed as a sustained increase in real per capita income which is accompanied by some improvement in income distribution.

found for achieving economic development, there must also exist the desire and the will to implement such policies. At the individual level, there is the basic assumption that those farmers having idle land possess utility functions which are heavily weighted in favor of high incomes. Given the proper knowledge, technology, and sufficient resources, and given incentives which allow retention of higher incomes, it is presumed the farmers would react in such a manner that their land would be utilized to achieve higher incomes for any given level of risk. With the prevailing situation being one of very low income and long seasonal unemployment, it is expected that the marginal utility of leisure time would be very low and the marginal utility of income would be quite high by comparison. This assumption repudiates what may be a popularly held belief; that low income is due to a generalized innate laziness or a high preference for leisure time. Without the income preference assumption, a large portion of the rural sector, and hence, a significant part of Mexican society would be indifferent to increased income which could result from more efficient utilization of idle land resources. The assumption of high income preference is consistent with in-the-field observations of the willingness of the Mexican peasants to expend huge amounts of physical effort to achieve rather minuscule income increases. At the same time, it is recognized that the assumption of high income preferences should not be pushed too far[10].

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[10]As an example, one case was found where the most successful early adopter of a new hybrid corn variety was singled out by the change agents to be their example for the rest (footnote continued on following page)

Once the credibility of the above assumptions is acknowledged, the following hypotheses become of concern since, to the extent they are verified, new measures may be found to increase real per capita incomes: 1) Idle land, as reported in the census, exists beyond what is explainable by statistical error; 2) Existence of this idle land is inconsistent with the optimum use of land resources; 3) Variables can be identified which suggest reasons for the existence of such idle land; and 4) By overcoming the deleterious aspects and enhancing the favorable effects of these variables explaining idle land, such land can be brought into productive use. The remainder of the thesis is largely directed towards the development and testing of these hypotheses.

Reliable empirical information is required if the procedures utilized in carrying out the objectives are to be valid. The present study is, to a large degree, based on Mexican Agricultural Census data which are supplemented by personal interviews at the farm level. Several factors limit the usefulness of the census data. First, the census is conducted only once every 10 years. Second, the county (municipio) level tabulation for the 1960 Mexican Agricultural Census was less complete than the state level tabulations. Finally the

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(continued from preceding page) of the village. However, when they inquired as to how large a planting was anticipated for the next year based on his outstanding success, the surprising response was: "None". He reasoned that God did not favor ambitious men. With the previous year's abundance, he was afraid any further plantings would be viewed by God as being overly ambitious. Although such examples may be readily found, the case study interviews overwhelmingly supported the high income preference assumption.

reliability of census data has been frequently questioned[11]. Although census data are selected for use, their shortcomings are mitigated in part by farm interviews which provide a means of verifying the census reliability.

A high degree of confidence is placed in the on-farm interview data. Aiding the author in obtaining this confidential and personal information were two years of previous experience of living and working with Mexican peasants, and accompaniment by his Mexican wife and small son during the interview visits. It is suspected he was aided in securing information even further by the fact that he was obviously not a Mexican, and therefore could not be associated with any Mexican governmental (especially taxation) agency. Surprisingly, more difficulty was encountered in gaining cooperation of the educated urban owners than from the traditional farmers in the more isolated rural areas. In addition, visits were

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[11]For an excellent discussion of inadequacies of census data, see: Barkin, David. Cambios en la agricultura de la zona de Tierra Caliente, Michoacán, México. 1950-60. Centro de Economía Agrícola, Escuela Nacional de Agricultura, Chapingo, México. 1965. In comparing the Census, Ministry of Hydraulic Resources and the Secretary of Agriculture as sources of data, Barkin concludes that the census is by far the best source for lower income, subsistence agriculture, but probably poor for commercial agricultural estimates. Thus, for irrigation districts, information collected by the Ministry of Hydraulic Resources is preferred. Further information as to census inadequacies can also be found in: Durán, Marco Antonio. Verosimilitud de las estadísticas agropecuarias. In Fernández y Fernández, Ramón, ed. Crédito Agrícola. Vol. VIII. (pages unnumbered). Centro de Economía Agrícola, Escuela Nacional de Agricultura. Chapingo, México. 1967, and in T. de la Peña, Moisés. El pueblo y la tierra: la realidad y el mito de la reforma agraria mexicana. Cuadernos Americanos, México. 1964. pp. 426-30., and, for special reference to land classification problems, see: Eckstein, Salomón. El ejido colectivo en México. Fondo de Cultura Económica. México 1966. pp. 272-282.

conducted in two areas which made use of American Friends Service Committee volunteers who were in a unique position of having widespread knowledge about and confidence of the rural peasants with whom they worked.

The procedure used to evaluate the importance of idle land to the agricultural sector (objective one of the study) consists of an examination of census indications of the extent of idle land as well as supporting evidence found in studies of other investigators. Regression and case study analyses further contribute to an evaluation of the importance of the idle land problem.

Determination of the reasons for idle land and their order of importance (objectives two and three of the study) was accomplished through the development of multiple regression models and the analysis of farm interviews. Regression models were developed at both the state and county level. County level analysis permitted greater disaggregation of the independent variables utilized and allowed incorporation of climatological data reflecting local conditions. The farm interview analysis provided a check on the census data reliability (objective six of the study). Inclusion of possible explanatory factors for which data was unavailable was made possible by the case study approach. Case study area selection was based on the following criteria: 1) high amounts of idle land reported in the census; 2) land ownership and idle land evenly distributed between the private and <u>ejido</u> land tenure classes; and 3) contrasting climatic conditions in each area.

Possible reasons for the idling of land which are explored in this study include the level and quality of resources used in the production processes, weather conditions, institutional considerations, off-farm employment opportunities, and census errors. For convenience in the formulation of policy recommendations (objective four of the study), the hypotheses developed to diagnose the reasons for idle land (diagnostic hypotheses) are classified into those with variables directly controllable by the firm; those with variables controllable at a higher level of decision making than the firm, and those with largely uncontrollable variables. The policy recommendations advanced are based on the outcome of objectives two and three wherein the models were applied to the data available. Yet, where both projected impact and acceptability to decision makers are involved, it must be recognized that considerable subjective judgment is exercised in selecting from the multitudinous policy alternatives available.

Future research needs (objective five of the study) were revealed by contradictory or inconclusive regression and field interview findings, by data deficiencies which prevented further study, and by new issues which arose while pursuing the original objectives.

## E. Organization of Material

The material is organized into nine chapters. Following Chapter I, which introduces the study, Chapter II treats current and prospective importance of the idle land problem, examining pressures exerted on the land base and how utilization of idle land might relieve these pressures. In Chapter III, a delimitation of the idle land problem is presented, examining the extent to which idle land occurs in Mexico. In Chapter IV, the nature of hypotheses in scientific inquiry is considered and the *a priori* hypotheses developed which are later tested. Chapter V contains an explanation of the models used to test the hypotheses, including a discussion of the advantages and limitations of the models which are employed. In Chapter VI, the models are applied to the data and the results presented. These results are summarized and interpreted in Chapter VII. Based on these results, remedial hypotheses are formulated in terms of recommended policy priorities in Chapter VIII. Chapter IX presents the summary and conclusions of the study.

## II. CURRENT AND PROSPECTIVE IMPORTANCE OF LAND RESOURCE UTILIZATION WITHIN MEXICO AND LATIN AMERICA

The first objective of this study is to determine the importance to Mexico's agricultural sector of utilizing any lands which are presently left idle. In this chapter, evidence is presented which indicates an imperative need to utilize more fully Mexico's land resources.

Several initial considerations warrant mention as a prelude to the reasoning which is developed. If Mexico were a country with such abundant land resources that those choosing to farm could be provided with adequate sized holdings; if Mexico had a slow rate of population growth so no future shortage of land was foreseen; if sufficient employment opportunities were available in the non-agricultural sector so agricultural employment was not critical, and, if capital and new technology were used so extensively that production surpluses could be expected--then the idle land problem would be of secondary importance. However, in this chapter the evidence found casts serious doubts on the preceding considerations, and suggests the idle land problem is of primary importance.

The first section of this chapter presents a historical perspective of the importance of land ownership to political stability. This appears necessary since economic development is not possible under conditions of extreme political instability. The failure to fulfill the historical hunger for land could again lead to political turmoil as has taken place in the past. In the second section, various aspects of population pressures illustrate the need for productive use of presently idle lands. A rather detailed analysis of the discrepancy between potential cultivable lands and claims against such lands leads to the conclusion that even utilizing presently idle land, the landless peasant would still be a widespread feature of Mexican agriculture.

The third section of this chapter suggests that efforts to utilize land presently left idle would be more beneficial than initiating new, high cost irrigation projects. The fourth section, in presenting reasons for concern with projected agricultural production, suggests that utilization of idle lands will become even more imperative in the future. The final section indicates that the idle land problem identified in Mexico may in fact by of widespread occurrence throughout Latin America.

## A. Importance of Land to Political Stability in Mexico

The fundamental role which land resources have played in Mexico's political stability can be traced back to the earliest history of Mexico. An appreciation of these historical antecedents is important since they reveal the reasons for the deep seated fears, attitudes, and norms that shape the Mexican approach to land ownership and utilization. The establishment of the _ejido_ land tenure system, with its roots in the precolonial period, can be seen as an outgrowth of the desire to forestall a return to the land concentration patterns and the confiscation of village lands which had occurred under the abuses of the _encomiendas_, the haciendas, the Church, and the foreign interests. The historical events reviewed here have resulted in a deep emotional and political importance of land ownership in Mexico. Thus, instances of idle or unused land take on much greater significance in Mexico than they might in other countries.

It is hypothesized that land tenure systems influence idle land. From a pragmatic point of view, this hypothesis is of interest only if remedial alterations in existing land tenure systems are feasible. The historical perspective helps elucidate why opposition might be encountered to alterations which otherwise would seem plausible.

It is possible that the role of land resources in the history of Mexico has not yet played its final scene. An unsatiated, historical hunger for land has been a predominant feature behind much of the political turmoil of Mexico. If left unsatisfied, it is a force which could again bring political unrest of major proportions. Productive use of idle lands may provide one means of meeting the desires of landless peasants.

1. Mexico before independence[12]

In the pre-Hispanic era of the Aztecs, among the three land tenure categories which existed were the village communal lands. The communal lands were of two types. The first, the calpullalli, were administered

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[12]For an expanded account of this fascinating period of Mexican history, see: Mendieta y Núñez, Lucio. El problema agrario de México. 9th ed. Editorial Porrúa, S.A. México. 1966. pp. 3-86.

by the elders but assigned to individuals for cultivation. Such lands could not be sold or rented, but could be passed on to heirs. If the lands were left uncultivated for more than three consecutive years all rights were forfeited and the land passed to another villager. By contrast, the second class of communal lands, the altepetlalli, were unfenced village lands used in common for grazing and firewood, or cultivated collectively to raise funds for taxes and public expenses[13].

By the end of the pre-Hispanic period, most of the communal lands had disappeared, with ownership of nearly all land in the Aztec empire being concentrated in the hands of the King, Nobles and Warriors. Thus, the forefather of the revolutionary army--the landless peasant--was already a definitely established social class when the Spanish conquerors arrived[14].

Under Spanish rule, large grants of land were made to recompense the conquerors and to encourage emigration. The strength of this private property group was enhanced through the encomienda system under which individuals were allotted Indian villages for the purpose of converting the Indians to Christianity and to "protect them"[15]. Included was the right to collect tribute and require personal services from the

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[13] Ibid. pp. 3-9.

[14] Simpson, Eyler N. The ejido; Mexico's way out. Chapel Hill, The University of North Carolina Press. 1937. p. 6.

[15] Ibid. pp. 9-10.

villagers[16]. Despite the original purposes, the encomienda degenerated into essentially legal slavery until excessive abuses caused it to be abolished in 1720. By that time, incorporation of much of the village lands into haciendas[17,18] enabled the land owners to maintain their power even with abolishment of the encomienda[19]. This "illegal grab" of Indian lands later became the basic justification of the ejido system and land redistribution[20].

The Church was also able to acquire vast land holdings despite laws prohibiting sale of land to it. It is estimated that one half or more of the real property and capital of Mexico belonged to the Church by the end of the colonial period. It also controlled much of the remaining wealth through its role of chief money lender[21].

Despite the "Indian Laws" established by the Crown to protect the

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[16] Whetten, Nathan L. Mexican land reform. Foreign Agriculture. v. 15, no. 9. Sept. 1951. p. 196.

[17] Ibid. p. 196.

[18] The attributes of a typical hacienda are discussed in interesting detail in: Tannenbaum, Frank. Ten keys to Latin America. Alfred A. Knopf, Inc. New York. 1962. pp. 75-94.

[19] McBride, George McCutchen. The land systems of Mexico. American Geographical Society Research Series no. 12. Condé Nast Press, Greenwich, Conn. 1923. pp. 60-61.

[20] Mendieta y Núñez. op. cit. p. 172, quoting from Zapata's Plan de Ayala.

[21] For a more extensive discussion of the role of the Church and attempts to curtail its powers, see: Simpson, Eyler N. op cit. pp. 19-24, and Mendieta y Núñez. op. cit. pp. 97-117.

indigenous population from the ambitions of the Spanish colonizers, the natives continued caught between the squeeze of the hacienda and the clergy in their struggle to preserve what remained of their traditional communal lands[22].

2. From Independence to the Revolution

By 1810, the desire for land had reached such proportions that it precipitated an agrarian uprising. The uprising later developed into the War of Independence as Indians and mestizos joined Father Hidalgo to defend their lands against the expanding hacienda. After a prolonged, confused and often contradictory affair, Independence was won. However, in the end, the Independence movement wound up being led by the very elements against whom the original uprising had been instigated--the landlords and the Church[23]!

For a long period following Independence, Mexico continued in a state of constant disturbance. Attempts made to correct the agrarian problems of excessive land holdings in latifundios and large population concentrations through colonization programs resulted largely in foreign colonization and often increased exploitation of the natives[24]. "Land Reform" laws passed to encourage renters to acquire land at low prices

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[22] Phipps, Helen. Some aspects of the agrarian question in Mexico. Univ. of Texas Bulletin no. 2515. 1925. pp. 24-25.

[23] Simpson, Eyler N. op. cit. pp. 18-19.

[24] Ibid. p. 27.

and require the Church to divest itself of its land contained an important flaw wherein claims could be filed against previously protected village communal lands. The net result of these "reforms" was an even greater concentration of land in the hands of the latifundistas. Their holdings swelled by addition of Church lands as well as some of the communal village lands[25]. Again, the reverse of the orginally desired effects resulted: private land ownership by individual peasants was not achieved, instead, more land passed to the latifundios. The attempt of Juarez to force villagers out of communal lethargy by substituting private land for communal land was a failure[26]. Instead, "A mortal blow was dealt to one of the most important and stable of Mexico's agrarian institutions. Whole communities for generations proud of their freedom and secure in their economic independence were reduced almost overnight to poverty and peonage"[27].

Political stability and satisfaction of land hunger continued to elude the grasp of the government. It was left to a dictator, Porfirio Diaz, to establish the long awaited political stability. However, the internal peace and economic development of the era[28] were accompanied by worsening income distribution and land ownership concentration. Survey

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[25]Mendieta y Núñez. op. cit. pp. 109-113.

[26]Simpson, Eyler N. op. cit. p. 25.

[27]Ibid. p. 25.

[28]Simpson, Lesley Byrd. Many Mexicos. 3rd ed. Univ. of Calif. Press, Berkeley and Los Angeles, California. 1960. p. 259.

rights (often sold to foreigners) allowed scrutiny of all property titles. What had seemed to be of "good title" was frequently lost in proceedings of an often dubious nature[29]. The situation worsened when the survey companies were allowed to acquire idle or unclaimed lands virtually without limit and without even the requirement that the lands be settled[30].

It is estimated that by 1910, less than three percent of the agricultural population owned any land. Of this three percent, the vast majority had an insufficient amount of land to make even a bare living[31].

The situation at the start of the Revolution is described by Edmundo Flores as follows:

> "There were in Mexico 8,431 haciendas and 48,633 ranches which summed to the total of 57,064 agricultural units. That was all! Of a population of 15 million, only 0.3 percent—less than one-third of one percent—were land owners. The rest.....as Zapata was to affirm in his Plan de Ayala, 'own only the land area under each foot'"[32, 33].

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[29] Tannenbaum, Frank. Mexico, the struggle for peace and bread. Alfred A. Knopf, Inc. New York. 1964 (c. 1950). pp. 138-140.

[30] The disastrous effects of this program are described in Phipps, op. cit. pp. 106-111.

[31] Tannenbaum. Struggle for peace. op. cit. p. 140.

[32] Flores, Edmundo. Cómo funciona el sector agropecuario de México. Comercio Exterior. vol. 17, no. 9. September 1967. p. 701.

[33] Despite discrepancies found as to the percent of the population owning land, it is obvious that ownership was concentrated in the hands of very few.

## 3. The Revolution

It is little wonder that out of the dissappointing experiences with the haciendas, colonization and foreign control, there grew deep seated doubts in Mexico as to the suitability of private property for the peasants. Nor is it surprising that land ownership would take on such a great social significance in Mexico, a fact attested to by the Revolution which ensued.

The Mexican Revolution was an Agrarian Revolution spurred by the rallying cry of "Land and Liberty". The rural population was starved for land. Even after the Revolutionary forces had won their battle for power, peace was not restored until the peasants, led by Zapata, received ample sign that land would be redistributed to the landless[34, 35].

Without abolishing private property (the advantages of which were desired)[36], some means had to be provided to prevent land from ever again returning to the latifundio. The principle was established that property rights were contingent on their use in ways beneficial to society[37]. The ejido system was selected to supplement private land

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[34] Simpson, Eyler N. op. cit., p. 51, and T. de la Peña. op. cit., p. 301.

[35] An interesting account of the demands and early governmental efforts to satisfy them during this period is found in McBride, op. cit., pp. 157-160.

[36] Simpson, Eyler N. op. cit., p. 73.

[37] Constitución Política de los Estados Unidos Mexicanos. Art. 27. Edición de la Cámara de Diputados. México. 1961. pp. 18-20.

ownership to meet these needs. _Ejido_ lands could not be sold, mortgaged, leased or placed under any type of lien[38]. The lands had to be worked directly by the recipients[39]. If uncultivated for more than two consecutive years, the lands were subject to forfeiture[40]. If abandoned or left idle, the land returned to the village to be reassigned[41]. The owner, however, could designate an heir to his _ejido_ lands[42]. Forest, pasture and unproductive lands were held in common by the villages[43]. Thus, today's _ejido_ is seen to be a direct descendent of the Aztec's _altepetlalli_ and _calpullalli_ community lands[44]. Although the communities had the option of utilizing the lands collectively or as individual parcels at present, nearly all _ejido_ cultivable land is farmed individually (97 percent)[45], the collective having largely died out (or, according to some, having been killed off)[46].

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[38] Leyes y Códigos de México. Código agrario y leyes complementarias. 17th ed. Editorial Porrúa, S.A. México. 1968. Art. 159. pp. 60-61.

[39] _Ibid._ Art. 159.

[40] _Ibid._ Art. 169.

[41] _Ibid._ Art. 170.

[42] _Ibid._ Art. 162.

[43] _Ibid._ Art. 131.

[44] Eckstein, Salomón. El _ejido_ colectivo. _op. cit._ p. 724.

[45] Calculated from information in: Secretaría de Indistria y Comercio. Cuarto Censos Agrícola - Ganadero. Resumen general. _op. cit._ p. 43.

[46] For an excellent study of the collective _ejido_--its problems, successes and possibilities, see Eckstein. El _ejido_ colectivo en México. _op. cit._

4. From the Revolution to the present

Despite declarations of the country's leaders that the ejido and private property will continue to exist side by side[47], no decision appears to have been made as to the ultimate relation between the two. From the original intent of income supplementation[48], it appears the ejido has come to be viewed as an economically independent unit which should provide at least a subsistence income[49]. However, notwithstanding the at times confusing swings by each administration to and from private property, the collective ejido, and the individual ejido, there can be little doubt that the agrarian reform, as it has evolved and continued over the last 50 years, has facilitated the maintenance of political stability[50]. And yet, the hunger for land continues to nip at Mexico's heels and with it bring uncertainty and at times even social unrest[51]. Private owners are wary of their neighboring ejidatarios. Livestock

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[47] See, for example: El Heraldo. México. Feb. 3, 1971, March 1, 1971, and March 12, 1971.

[48] Simpson, Eyler N. op. cit., p. 73. and T. de la Peña. op. cit., p. 301.

[49] Fernández y Fernández, Ramón. Estudio del problema agrario actual. In Crédito Agrícola. Fernández y Fernández, Ramón. ed. Vol. 12. Centro de Economía Agrícola. Escuela Nacional de Agricultura. Chapingo, México. 1968. pages unnumbered. Also see El Heraldo. Feb. 3, 1971.

[50] Glade, William P. Jr. Revolution and economic development. In Glade, William P. Jr. and Anderson, Charles W. The political economy of Mexico. Univ. of Wisconsin Press. Madison, Wisconsin. 1963. p. 27 and p. 59.

[51] Fernández y Fernández, Ramón. Estudio del problema. op. cit. Also see El Heraldo. Feb. 14, 1971, ibid. April 14, 1971, and ibid. March 2, 1971.

raisers (often with extensive holdings) are especially defensive about their land ownership. Concrete examples of social unrest are manifest in the actions of paracaidistas ("paratroopers") who "fall from the skies" on land they desire. As they proceed to try and establish claims to these lands, owners are often kept away at gunpoint and the use of federal troops or state police is required to evict the squatters. In addition, one must add the discontent of many who possess "derechos a salvo"--promises of land "as soon as it becomes available". These individuals are kept in the landless peon class waiting for a promise which in many cases will probably never be fulfilled[52].

Desire for land has not turned itself against the government as it did in the armed conflicts of the past, yet, there are unsettling signs that the history of land conflict, here briefly reviewed, could again repeat itself. For example, student uprisings against the Diaz Ordaz regime included appeals for the neglected, land deprived, rural population.

Perhaps the most succint statement of the importance of land to political stability in Mexico is found in the comments made by Francisco Javier Alejo in a recent book review[53]:

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[52] Fernández y Fernández, Ramón. Estudio del problema. op. cit. Also see Solórzano Alcaraz, Adolfo. Tenencia de la tierra y crédito agrícola en Colima. In Fernández y Fernández, Ramón. ed. Crédito Agrícola. Vol. XI. (pages unnumbered). Centro de Economía Agrícola. Escuela Nacional de Agricultura. Chapingo, México. 1967.

[53] Alejo, Francisco Javier. Reforma agraria traicionada? (Book review of: Tello, Carlos. La tenencia de la tierra en México. Instituto de Investigaciones Sociales, Universidad Nacional Autónoma de México. México. 1968.) In: Comercio Exterior. vol 18, no. 7. July, 1968. p. 621.

> "According to Carlos Tello, all of the armed movements in Mexico have each time been, to greater or lesser degree, a battle for the land....There is only one conclusion which can be reached after reading this book, and that is that the great social movements in Mexico, armed or not, will continue being battles for the land."

The foregoing discussion is not meant to imply that desire for and uncertainty surrounding land ownership have written the history of Mexico. Rather, land hunger which time and again has led to political unrest in the past could again bring instability. Colonization attempts, irrigation developments and expansion of the *ejido* attest to the government's recognition of the importance of expanding land ownership. It is the author's belief that land hunger will continue to exert pressure on the government, and, if the land turmoil of Mexico's history is not to be repeated, utilization of all available land will have to be intensified. It is not suggested that idle lands are sufficient to satisfy the desire for land ownership, rather they are a neglected resource whose development could provide an alternative for meeting the peasants salient desire for land ownership[54].

The importance of utilizing any available idle land becomes especially apparent when note is taken of an exploding population which shows little sign of subsiding. This population increase not only makes it difficult to provide the landless with the promised "plot of land"

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[54] Support of this view as to cultural differences in attitudes regarding land ownership is found in Eastman, Clyde, *et al*. A comparison of Anglo and Spanish-American attitudes toward land use and ownership. Western Agricultural Economics Association Proceedings, 1970. 1971. pp. 179-187.

but also results in unemployment and dietary problems. The following section focuses on the potential of idle land to relieve some of these population pressures.

### B. Population Pressures on Land Resources

The persistent desire for land ownership which has been a historical characteristic of Mexico assumes greater importance when joined with projected population increases. The first aspects of population pressures examined in this section include the rates of increase and geographical distribution of population. An undesirably high rate of rural to urban migration is occurring, allegedly due to population pressures on land resources. With little sign of the population explosion subsiding, more intensive land utilization, and by implication, greater utilization of idle lands, offers one possibility for slowing this migration. The serious dietary and unemployment problems (topics of the second and third sections) are also intensified by the rapid population increase.

The social significance of land ownership was established in part A of this chapter. The final section of part B treats in detail the persistent minifundio problem. When available land resources are compared with those required to provide all peasants with an adequate sized plot of land, the impossibility of such a measure is revealed--<u>even if</u> presently idle lands are fully utilized. An understanding of the population pressures described is essential to evaluate the potential importance of idle land as a means of facilitating agricultural development.

1. Present and projected demographic situation

a. Rates of increase in population During the 1940-61 period, the birth rate in Mexico experienced continual increase, moving from 44.3 to 45.6 births per thousand population, while the death rate decreased sharply from 26.6 per thousand in 1930 to 10.0 in 1964[55]. The result was an annual rate of increase in population for the 1950-60 period of 3.1 percent[56]. According to FAO figures[57], only eight other countries of the world had rates which surpassed Mexico's. Projections for 1965-75 indicate the population of Mexico will increase at an annual rate of 3.6 percent--barely second in the world to Costa Rica's 3.7 percent. And, for the 1975-85 estimates, the "low" projected rate of 3.0 percent and the "high" rate of 3.5 percent would be surpassed by only four to five countries. The projections were all based on the assumption that fertility rates in the future will be constant or lower than those presently experienced—a trend which is yet to be proven.

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[55]Presidencia de la República. Secretaría Privada, y Nacional Financiera, S.A. Subgerencia de Investigaciones Económicas. Cincuenta años de Revolución Mexicana en cifras. México. 1963. p. 221.

[56]Benítez, R. Zenteno and Cabrera, G. Acevedo. The future population of Mexico: Total, urban and rural. In United Nations. Proceedings for the World Population Conference, Belgrade, 1965. Vol. II, 1967. pp. 54-58.

[57]United Nations. Food and Agriculture Organization. Committee on Commodity Problems, 41st Session, Agricultural commodities: Projections for 1975 and 1985. Vol. II, Rome. 1967. pp. 6-9.

Ample potential is found in Mexico for these forecasts to be exceeded as occurred in 1960[58]. In a recent study comparing 18 Latin American countries[59], Mexico's life expectancy of 60 years and her infant mortality rate of 64 deaths per one thousand births were found to be little better than the average for Latin America. In the case of inhabitants per physician, Mexico is below the regional average, and is surpassed or equalled by 15 of the 18[60] in terms of hospital beds per 100,000 inhabitants. Concern in Mexico for improving these health conditions could easily result in population increases surpassing the above projections.

With regard to the projected decrease in fertility rate, it should be stated that no effort has been made by the national leaders to encourage birth control. It appears that in addition to social and religious obstacles, there are certain ingredients of nationalism which

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[58] United Nations projections made for Mexico in 1954-55 for 1960 underestimated the actual census results by 5.6 percent in the highest projection and underestimated population by over ten percent in the lowest estimate, despite the very short period of forecasting involved. For a discussion of the reasons, see Palaez, Cesar A. The degree of success achieved in the population projections for Latin America made since 1950. In United Nations Proceedings for the World Population Conference. Vol. III. Belgrade, 1965. pp. 27-33.

[59] Agency for International Development. Economic data book: Latin America. Washington, D.C. 1967. Chapter on Latin America. p. 4-5.

[60] If figures are used from the chapter on Mexico, rather than the chapter on Latin America in ibid., Mexico is surpassed by all countries studied.

inhibit any efforts to decrease present birth rates[61].

Not only has Mexico one of the highest rates of population increase in the world, but it appears it will continue to be one of the world's most rapidly increasing populations--perhaps increasing even more rapidly than present projections indicate. It is expected that within the next twenty years, Mexico will move from its position of 13th most populous country in the world to one of the "top ten", surpassing at least France, Italy and the United Kingdom[62].

b. Changes in geographical distribution Mexico is becoming increasingly urban. Although the official definition of an "urban city" as any with over 2,500 inhabitants may be inadequate[63], by this definition, a population of 65 percent rural in 1940 has steadily diminished to 57 percent in 1950[64], and to 49 percent in 1960[65]. It is projected that

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[61] In fact, according to Gross, "from the Mexican viewpoint, the population explosion is a benign even that may lead to larger domestic markets and a greater role in world affairs. See Gross, Bertram M. Preface to Shafer, op. cit. p. xiii. Stycos also cites Mexico as a country where national leaders seem to feel the desirability of ever more and more Mexicans as an appropriate goal. See Stycos, J. Mayone. Problems of fertility control in under-developed areas. In Mudd, Stuart, ed. The population crisis and the use of world resources. World Academy of Art and Science, vol. 2. Indiana Univ. Press. Bloomington, Indiana. 1964. pp. 94-108.

[62] Gross. op. cit. p. xiii.

[63] For further discussion of this point, see Cline, Howard. Mexico: Revolution to evolution. 1940-60. Oxford Univ. Press. London. 1962. pp. 101-103.

[64] Shafer. op. cit. p. 17.

[65] Secretaría de Agricultura y (footnote continued on following page)

the rural population will have decreased to only 36 percent by 1975[66].

Mexico City is a story in itself. It has leaped from 2.2 million in 1950 to 4.5 million in 1960, making it the sixth largest city in the world. And, it holds an increasing proportion of the total population, rising from 8.6 percent in 1950 to 13.1 percent in 1960[67]. Industrial location has also become more concentrated some 41.3 percent of industrial production originating from Mexico City and its surrounding area as of 1960[68].

Important to idle land consideration is the fact that population concentration in the large cities has been attributed more to the growing pressure on the land than to the attractions of urban life[69]. A study of recent migration trends found heaviest heaviest emigration from the land had occurred in the central states (excluding Mexico City and surrounding area) where population density is greatest and where

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(footnote continued from preceding page) Ganadería, Secretaría de Hacienda y Crédito Público, Banco de México, S.A. Proyecciones de la oferta y la demanda de productos agropecuarios en México. 1965, 1970 y 1975. México. 1965. p. 37.

[66] _Ibid._ p. 37.

[67] Cline. _op. cit._ pp. 103-105.

[68] Venezian and Gamble. _op. cit._ p. 38.

[69] Lewis, Oscar. Mexico since Cárdenas. In Council of Foreign Relations, Inc. Social change in Latin America today: Its implications for United States policy. pp. 285-345. Vintage Books. New York. 1960. pp. 288-289.

agricultural advancement has been meager[70]. High emigration was also encountered in the Gulf and South Pacific regions. The North and North Pacific regions, together with Mexico City, have gained in population through internal migration. Thus, migration has been from regions of low agricultural investment to those of high investment[71]. Interestingly, except for the densely populated Central region, migration has also occurred from those areas having relatively high amounts of idle land. The South Pacific and Gulf regions of high emigration have nearly 60 percent of their cultivable land left idle, whereas the low emigration regions of the North and North Pacific have slightly under 40 percent idle[71a].

The future rate of increase in cultivable land is expected to lag behind the increase in agricultural labor (see Table 2.1). These projections show agricultural labor increasing at a rate of 1.5 percent annually over the 1961-75 period, whereas cultivable land will drop from a rate of increase of 1.5 percent to only 1.1 percent for the 1971-75 portion. If these projections are accurate, the result will be less land per agricultural worker in the future. Added to the gravity of the

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[70] Myers, Charles Nash. Education and national development in Mexico. Princeton University Industrial Relations Sections. Princeton University. 1965. pp. 68-73.

[71] As seen in Appendix I, Table A.6, investment in agriculture is dominated by irrigation expenditures. The low priority granted to the Gulf and South Pacific regions is seen in Appendix I, Table A-7.

[71a] State and regional idle land figures are found in Table 3.2, pp. 86-87.

situation is the serious doubt as to the non-agricultural sectors' ability to absorb the 5.4 percent annual increase indicated, or at least absorb this population in any meaningful employment[72].

Table 2.1. Projected rates of increase in population and cultivable land

| | Annual rate of increase (percent) |
|---|---|
| Total cultivable land area[a] | 1.4 |
| Total labor force[b] | 3.5 |
| agricultural labor force[b] | 1.5 |
| non-agricultural labor force[c] | 5.4 |

[a]Based on a rate of increase of 1.5 percent for 1961-70 and 1.1 percent for 1971-75. Secretaría de Agricultura, et al. Proyecciones. op. cit. p. 95.

[b]1961-75. Ibid. p. 38 and p. 111.

[c]1960-70. Eckstein. El marco macroeconómico. op. cit. p. 164.

With such projections indicating a decreasing land to labor ratio in agriculture, and a migration from areas of low agricultural investment, the potential role of idle land assumes increasing prominence. By providing greater agricultural employment opportunities, the idle land reserve could be an important aid in slowing the push from the farm to the city which has resulted in unemployment, housing shortages, and the need for expensive public services.

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[72]See pages 37 - 39 for a more complete analysis of the urban unemployment problem.

2. Present and projected dietary situation    A strong argument supporting the need for efficient utilization of land in Mexico is provided by an examination of prevalent dietary deficiencies. Few probably suffer from acute hunger, yet, there are many who apparently suffer from malnutrition and poorly balanced diets.

Calcium, iron and thiamine minimum requirements are generally being met with little difficulty. However, this is not true in the case of Vitamin C, riboflavin, and especially Vitamin A, which reveals a deficit of over 50 percent of the minimum requirements (see Appendix I, Table A.1). By 1965, Mexico's estimated daily caloric intake of 2,667 calories exceed the FAO minimum recommendations of 2,600 for underdeveloped countries with large infant populations. Present caloric intake appears adequate for the needs of Mexico, especially since caloric distribution is fairly even among different income groups (see Appendix I, Table A.2).

The situation with respect to protein consumption is not favorable. For the 1960-75 period, total per capital consumption is expected to increase from 67 grams to only 69.3 grams[73]. The unsatisfactory situation in animal protein consumption is revealed in Appendix I, Table A.3. Per capita consumption of red meat in Mexico is surpassed or equalled by all area of North and South America reported except Peru and Ecuador. The animal protein component is expected to increase from 28.7 percent

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[73] Secretaría de Agricultura et al. Proyecciones. op. cit. p. 92.

to 35.5 percent by 1975[74], unfortunately, even this increase would leave the country well below the minimum recommended standard of 30.1 grams set by the Mexican National Institute of Nutrition[75]. The protein consumption situation is complicated by its sensitivity to levels of income (see Appendix I, Table A.4). It is estimated that in 1963, only five percent of the population was able to reach the recommended level of animal protein consumption, with 62 percent having received half or less of the recommended amount. The study by Ramírez and Châvez[76] concurs with the Secretaría de Agricultura study[77] indicating dietary deficiencies in animal protein will remain difficult to remedy for some time into the future.

In summary, despite great advances made since 1940 in dietary improvement, large imbalances continue in the average diet, with exaggerated proportions of cereal (especially corn), and with low consumption of animal products, fruits and vegetables[78]. Unfortunately, the latter are precisely the products for which large production deficits are predicted[79], indicating dietary improvement may be slow and difficult to

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[74] Calculated from information contained in ibid. p. 92.

[75] Ibid. p. 93.

[76] Ramírez, Juan Hernández and Châvez, Adolfo V. La disponibilidad de alimentos en México en el último cuarto de siglo. Comercio exterior. vol. 18, no. 12. December, 1968. pp. 1077-1082, see p. 1081.

[77] Secretaría de Agricultura et al. Proyecciones. op. cit. pp. 92-93.

[78] Ramírez and Châvez. op. cit. p. 1082.

[79] See pages 68 - 72 for discussion of production projections.

attain. Moreover, much of the advance since 1940 reflects improvement for only a small portion of the population. For the rural and urban poor, the only improvement has been alleviation of the acute hunger of the past through increases in the quantity of corn consumed[80].

According to Ramírez and Chávez[81], there is ever present the possibility of a nutritional crisis, especially when the rate of population increase is joined with agricultural production problems foreseen. The dietary problems are pervasive enough that idle land utilization should not be overlooked as one means of supplying the desired nutritional levels.

3. Importance of land utilization to the unemployment problem

a. The general unemployment situation Unemployment is another aspect of the population pressures on available land resources. Frederick Harbison suggests the typical underdeveloped country's wage differential between the "modern" and agricultural sector is ten times that of advanced countries[82]. As a result, high urban wages act as magnets, drawing people from rural areas. But, with a modern sector unable to create jobs rapidly enough, permanent and growing unemployment problems soon

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[80] Ramírez and Chávez. *op. cit.* p. 1082.

[81] *Ibid.* p. 1082.

[82] Harbison, Frederick H. Education in the Development Process. In Michie, Allan A., ed. Diversity and interdependence through international education. Education and World Affairs. New York. 1967. pp. 131-139, p. 131.

develop. He concludes that "you are left with the proposition that somehow or other, people have got to be left on the land". Yet, "the demonstration effect and the whole move toward modernization and the spread of education makes them want to move away..."[83].

This general situation described by Harbison seems to characterize Latin America as well. Franciso Aquino, in his report to the Inter-American Development Bank, stated that even with rapid industrial growth, the industrial sector has often been unable to absorb the available urban labor force, much less any excess labor from the rural sector[84]. With an even slower rate of absorption of labor by industry anticipated for the future by Mitchell and Schatan[85], little hope is found for agriculture's unemployed and underemployed which are estimated to comprise 33 to 50 percent of the agricultural labor force.

The conclusion of Mitchell and Schatan sounds strikingly similar to that of Harbison:

> "The need is evident for agriculture to retain a greater proportion of the campesino population; but for this, the existence of work opportunities under more efficient and productive conditions and for land holdings of economically viable size are imperative"[86].

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[83] Ibid. p. 137.

[84] Aquino, Francisco. Inaugural session address. In Banco Interamericano de Desarrollo El desarrollo agrícola de América Latina en la próxima década. Mesa redonda. pp. 5-14. Washington, D.C. 1967. p. 8.

[85] Mitchell, Clyde and Schatan, Jacobo. La agricultura en América Latina: Perspectivas para su desarrollo. pp. 47-156. In Banco Interamericano de Desarrollo, El desarrollo agrícola de America Latina en la próxima década Mesa Redonda. Washington, D.C. 1967. pp. 50-51.

[86] Ibid. p. 50.

It is generally held (but statistically unsubstantiated) that high unemployment and underemployment exists in Mexico[87]. However, the Mexican case is viewed as caused by pressures on the land <u>pushing</u> people into the city, rather than city attractions being the magnet[88]. A rough estimate encountered suggests 25 percent of the labor force in <u>urban</u> centers is excess labor--that is, either unemployed or of marginally productive employment[89]. To this must be added the agricultural unemployment situation described below.

b. <u>The agricultural unemployment problem</u> In the agricultural sector, the very low productivity encountered compared to other sectors is felt to be a consequence of high underemployment in agriculture. With 53 percent of the labor force in 1965, only 16 percent of the gross national product was generated by this sector. The seriousness of this situation

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[87] It is unfortunate that for such a basic problem as unemployment there are so few empirical studies available. The recent, "most complete" study of the Secretary of Industry and Commerce, using a sample of 25,000 families, concluded that unemployment was not a problem of importance to Mexico. However, close examination reveals the results to be patently inadequate if not ridiculous. The study found no maids looking for work in 21 states, no women looking for employment in 18 states, no agricultural workers looking for jobs in six states, and, in three states, no one desiring to work was unemployed. See Secretaría de Industria y Comercio. Dirección General de Muestreo. La población económicamente activa de México en junio de 1964. Vol. 1-3. Oct. 1964, and ________. La población económicamente activa de México en Abril de 1965. Vol. 4-7. <u>circa</u> Oct. 1965.

[88] Lewis, Oscar. <u>op</u>. <u>cit</u>. pp. 288-289.

[89] Flores de la Peña, Horacio. México: Una economía en desarrollo. Comercio Exterior. Vol. 13, no. 8. pp. 557-568. August 1963. p. 559.

for Mexico is revealed in a comparison of 17 other Latin American countries (see Appendix I, Table A.5). Only Venezuela is lower than Mexico in the relative productivity of agriculture. And, in the case of Venezuela, the problem is less serious, since a much smaller percentage of its labor force is dependent on agriculture.

It is important to determine more exactly the extent and nature of underemployment in agriculture before the possible role of idle land in relieving agricultural underemployment can be assessed. This is approached in two ways. First, the nature of rural to urban labor transfer is studied. This is followed by an analysis of the number of man days utilized in the agricultural sector.

c. Rural to urban labor transferral If equal rates of family growth are assumed in the agricultural and non-agricultural sectors[90], and the observed rates of increase compared, the rate of net transfer of labor from agriculture to non-agriculture can be computed as a percentage of the total economically active population (see Table 2.2). On this basis, the rate of transfer declined from 23.7 percent in 1940-50 to 16.8 percent in 1950-60 as a percent of increase in total economically active population, or from 36.2 percent to 28.2 percent as a percent of increase in the agricultural economically active population.

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[90]Actual live birth rates found by Benítez and Cabrera were 2.39 and 2.93 for the rural and urban sectors respectively. See Benítez and Cabrera. op. cit. p. 58.

Table 2.2 Rural to urban labor transferral rates[a]

| | 1940-50 | 1950-60 |
|---|---|---|
| Net transfer (thousands) | 590 | 478 |
| Transfer rate as percent of increase in: | | |
| total economically active population | 23.7 | 16.8 |
| agricultural economically active population | 36.2 | 28.2 |
| non-agricultural economically active population | 68.4 | 39.5 |

[a]Source: Eckstein, Salomón. El marco macroeconómico del problema agrario mexicano. Documento preliminar. Centro de Investigaciones Agrarias. México. 1968. p. 149.

Was the agricultural sector incapable of freeing more than 28 percent of its increase during 1950-60 compared with 36 percent the previous decade? Or, was the non-agricultural sector unable to absorb more than 39.5 percent over its natural increase compared to the previous 68.4 percent? The answer to these questions would indicate future employment opportunities in the cities.

The Secretaría de Agricultura's study suggests ample opportunities for employment will be available in the cities. It has projected (see Appendix I, Table A.8) the economically active population in agriculture to increase at an annual rate of only 1.5 percent while that of the increases at a rate of 5.2 percent "favored by the expanded occupational opportunities in urban based industry and services"[91].

However, the projections indicate a reversal in the experienced growth rate of the cities which decreased from 5.5 to 4.1 percent between 1940-50 and 1950-60. Furthermore, the drop in the agricultural growth rate to only 1.5 percent appears to be rather great. An analysis of this rate of increase in non-agricultural economically active population (see Table 2.3) suggests these projections may be too low, a situation which would make the cultivable land to labor problem discussed earlier[92] even more severe.

Table 2.3 Population, product and productivity trends; non-agricultural sector[a]

| | Annual rate of increase: 1940-50 | 1950-60 |
|---|---|---|
| | (percent) | (percent) |
| Gross National Product (GNP) | 6.9 | 6.6 |
| GNP/economically active population | 1.3 | 2.5 |
| Economically active population | 5.5 | 4.1 |

[a]Source: Eckstein. El marco macroeconómico. op. cit. p. 151.

The increase in gross national product generated by the non-agricultural sector slowed from 6.9 percent in 1940-50 to 6.6 percent in 1950-60 (Table 2.3). At the same time, "productivity per worker" (GNP/economically active population) increased from 1.3 percent to 2.5 percent. The

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[91]Secretaría de Agricultura et al. Proyecciones. op. cit. pp. 37.

[92]See pages 33-34.

result was the lower increase in the non-agricultural economically active population.

The increase in productivity per worker (Table 2.3) could be advantageous, resulting from labor scarcity and reflecting an increase in per capita income. But, it could also reflect an adverse employment situation. Eckstein suggests the latter is the case, as seen in "the large masses of people searching for work" since the rise in productivity per worker resulted from increased amounts of capital utilized in industry "for motives of prestige as well as profit"[92a]. The lower transfer rate of labor from agriculture resulted when the agricultural sector had "done its share" in releasing labor for economic development, but the non-agricultural sector failed to fulfill its "obligation" to employ productively the labor set free[93]. The increased underemployment in agriculture explains the low productivity of labor found there. The findings cast further doubt on the optimistic projections of the Secretaría de Agricultura as to the employment opportunities which will be generated by the non-agricultural sector and suggest the need will become increasingly great to utilize idle lands to provide employment in the agricultural sector.

Another indication of agricultural underemployment and limited urban employment opportunities is found in the bracero program (temporary agricultural workers) and emigration experiences. Here, "rural labor

[92a]Eckstein. El marco macroeconómico. op. cit. p. 152.

[93]Ibid. p. 165.

transfer" reaches the extreme situation of emigration beyond national boundaries.

Lewis indicates Mexico has been a country of emigration since the beginning of the century due to population pressures on poor and limited agricultural land resources combined with employment opportunities in the United States. The number of Mexicans establishing permanent residence in the United States increased from an annual average of 2,200 in 1931-40 to over 61,000 by 1955[94]. To this figure must be added the many legal and illegal entries by Mexican workers. From 1955 through 1958, about 400,000 workers per year entered under the _bracero_ program. From 1953-55, some 1.7 million Mexicans were arrested during "Operation Wetback" of the border patrol[95, 96].

In one village studied by Lewis, a situation of acute land shortage in the mid-1940's changed to one of manpower shortage in 1950. Many fields were actually left idle because of men having gone to the United States as _braceros_[96a]. Thus, the _bracero_ program served as a buffer, lending a partial, if temporary and inadequate, solution to the chronic

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[94] Lewis. _op. cit._ pp. 291-292.

[95] _Ibid._ p. 292.

[96] Added to these figures should be the unknown thousands who left voluntarily to avoid arrest and others who escaped arrest, aided at times by sympathetic United States farmers.

[96a] Lewis. _op. cit._ p. 293.

agricultural underemployment problem of Mexico[97]. There is no doubt that termination of the program has added to the serious pressures on Mexico's land resources.

Off-farm employment measurements also indicate increasing underemployment difficulties in the _ejido_. First, the percentage of _ejidatarios_ who worked their land dropped from 95 percent in 1940 and 1950 to 89 percent in 1960[97a]. Permanent or temporary land abandonment probably caused this drop[98]. Second, the percentage of those _ejidatarios_ who searched for and found supplementary employment off the _ejido_ has steadily increased from 25 percent in 1940 to 35 percent in 1960[99]. Closely related, those _ejido_ families covering over half of their living expenses with _ejido_ production decreased from 84 percent in 1950 to only 66 percent in 1960[100]. Thus, even the sector which "cannot rent or sell"

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[97] While acting as a safety valve to the rural population, it was at the same time a blow to national pride that so many Mexicans should desire to leave their country, paradoxically, at a time when the economy was booming.

[97a] Eckstein. El marco macroeconómico. _op. cit._ p. 183.

[98] Estimates on land abandonment differ widely, yet it appears to be an important problem. In the President's report (1968), some 7,300 "officially" lost their _ejido_ rights due primarily to land abandonment (see The News. September 2, 1968. Mexico.). Martín Martínez Delgadillo has estimated that about one-quarter of all distributed land has been abandoned at some time and another one-quarter has been relinquished to others or is a matter of legal dispute (see The News. April 15, 1968. Mexico.). Further discussion of the land abandonment problem is found on pages 93-94.

[99] _Ibid._ p. 183.

[100] _Ibid._ pp. 183-184.

its land is increasingly turning to off farm employment where it is available, as the ejido system finds it increasingly difficult to meet the needs of its members.

d. <u>Agricultural underemployment as measured by man days utilized</u>

The amount of man days utilized per holding provides an alternative to rural emigration as a measure of agricultural employment problems. Data limitations make comparisons difficult, however, Eckstein has arrived at some approximate values of man days utilized in agriculture through a series of rather valient assumptions[101].

The estimated national average of 276 man days utilized per holding (Table 2.4) would indicate adequate employment for family units. However, wide differences between tenure groups reveal a situation far short of full employment, with the *ejido* utilizing only 200 man days and holdings under five hectares only 60 man days per year[102].

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[101] *Ibid*. pp. 171-182. Examples include the assumption that labor per hectare used for each crop is the same for all tenure classes, and that hired labor can be estimated by dividing the amount spent on hired labor reported in the census by the minimum rural wage.

[102] Special note should be made of the category "man days utilized per hectare" in Table 2.4. Greater labor use in holdings over five hectares is attributed to more intensive cultivation and greater labor use in livestock production compared to the other sectors. This itself is an interesting finding since it suggests the larger private farmers use more labor *per hectare* than the *ejido* or small private farmer. See Eckstein. El marco macroeconómico. *op. cit.* pp. 172-173.

Table 2.4. Man days of labor utilized by tenure group and activity[a]

| Man days utilized | Nation-wide | Private holdings over five hectares | Private holdings five hectares and under | Ejido holdings |
|---|---|---|---|---|
| per holding in: | | | | |
| crops | 202 | 702 | 43 | 159 |
| administration | 26 | 86 | 6 | 22 |
| livestock | 48 | 236 | 12 | 19 |
| total | 276 | 1024 | 61 | 200 |
| per hectare: | 52 | 59 | 54 | 45 |

[a]Source: Eckstein. El marco macroeconómico. op. cit. p. 172.

A more severe underemployment picture is revealed when account is taken of family and hired labor contributions. Man days worked by hired labor were estimated by using total payments to hired labor divided by the minimum rural wage. Subtracting this from the figures in Table 2.4 results in man days worked by the family per holding (Table 2.5). Considering 250 man days as "full employment"[103] the level of employment can be found as a percent of "full employment" (see Table 2.5).

By this criteria, underemployment in the ejido and small private

[103]Employment levels indicated in Table 2.5 can also be considered as percentages of employment compared to operators of private holdings of over five hectares, since the 250 man days "full employment" criteria is the same as the estimated 250 man days utilized per operator on private holdings of over five hectares. See Eckstein. El marco macroeconómico. op. cit. p. 175.

holdings would be 25 and 86 percent respectively if only the operator worked. If the operator is joined by the male family members over 15 years old, these underemployment rates jump to 58 and 92 percent. Disregarded are many members under 15 years old and frequent female labor used for agricultural work.

Table 2.5. Operator and family man days utilized and employment rates as a percentage of "full employment"[a]

| | Private holdings five hectares and under | Ejido holdings |
|---|---|---|
| Total man days worked by family (million) | 17 | 265 |
| Total man days worked by family, per holding | 36 | 186 |
| Employment rate if only operator employed | 14% | 75% |
| Number of workers, operator plus male family members over 15 years old (thousand) | 860 | 2511 |
| Man days worked per operator plus male family members over 15 years old | 20 | 105 |
| Employment rate if all operator plus male family members over 15 years worked equally | 8% | 42% |

[a]Source: Eckstein. El marco macroeconómico. op. cit. p. 177.

Turning to hired labor utilization, severe underemployment is again encountered. Although man days worked by the total agricultural economically active population increased from 110 in 1950 to 117 in 1960, the number of man days worked by hired labor decreased from 194 in 1950 to 100 in 1960 (Table 2.6). Serious deterioration in the number of days worked by hired laborers is found in all three tenure classes. At the same time, it is seen that the number of hired laborers employed per holding increased in all three tenure classes. With a decrease in man days employed yet an increase in the number of hired workers utilized, less work is apparently being spread over a larger labor force, resulting in less employment per worker[104].

Table 2.6. Hired labor utilization by tenure group, 1950 and 1960[a]

| Tenure class | Man days worked per hired laborer 1950 | Man days worked per hired laborer 1960 | Number of workers hired per holding 1950 | Number of workers hired per holding 1960 |
|---|---|---|---|---|
| Total | 194 | 100 | | |
| Private holdings over five hectares | 310 | 135 | 2.48 | 2.58 |
| Private holdings, five hectares and under | 128 | 60 | .25 | .40 |
| Ejido holdings | 58 | 49 | .38 | .45 |

[a]Source: Eckstein. El marco macroeconómico. op. cit. pp. 199-200.

Although caution is again urged as to the accuracy of these estimates, the overall trends suggest widespread and severe problems of underemployment in the agricultural sector, and the inability of the non-agricultural sector to relieve agricultural underemployment problems. Eckstein blames the large farmers as well as the non-agricultural sector

[104]Based on earlier discussions (see pages 37-39), it seems improbable that the decrease in man days worked by hired agricultural labor can be attributed to expanded urban employment opportunities for these laborers.

for the deteriorating agricultural employment problem wherein the high adoption rates of machinery turn out to be not a substitute for human physical effort, but for human employment[105, 106].

In general, the above findings on agricultural underemployment fit well with the field interviews conducted during this study and with the suggestion of Edmundo Flores that 25 to 40 percent of the economically active rural population are employed for periods of only four to five months a year[107].

Utilization of idle land is seen as a possible alternative for relieving population and unemployment pressure. Mexico is already actively pursuing a "rural transformation" campaign to increase the attractiveness of rural living, placing major emphasis on building roads, rural hospitals, recreation centers, and bringing electric power, telephone and telegraph services to rural areas. By utilizing idle land and by continuing to make the rural environment more attractive, opportunities would be enhanced for retaining more people on the land.

4. The minifundio problem    Further evidence of population pressures resulting in the need for efficient utilization of land resources is

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[105] Eckstein. El marco macroeconómico. op. cit. pp. 201-203.

[106] This contradicts to some degree the finding of increased numbers of workers employed per holding among the larger sized farms (Table 2.6), which can not be attributable to increase in farm size (as seen in Table 2.11).

[107] Flores, Edmundo. Tratado de economía agrícola. Fondo de Cultura Economica. México. 1961. pp. 366-367.

found in the minifundio (undersized holding) problem. In this section, estimates of available cultivable land are compared with land needs as evaluated against legal norms establishing the minimum size of ejido holdings. Trends in the size of farm plots are then examined as an indication of possible future needs.

In 1942, the Agrarian Code was passed which is still in effect[108]. One important change was to increase the minimum legal size per ejido plot from four to six hectares of irrigated land[109]. In 1946, this provision was again altered to enlarge minimum size of ejido holdings to ten hectares of irrigated land, or 20 hectares of seasonal land, plus pasture and other lands as required to cover the ejido's needs[110]. The only limit placed on maximum size was that the area be "utilized efficiently" by the ejidatarios, "keeping in mind the machinery and tools available for cultivation"[111]. The minimum size continues to be set by this legally established norm.

a. Available land Difference in opinion abounds as to potential cultivable land available to Mexico. The Secretaría de Agricultura study sees increasing difficulty in opening new land to cultivation,

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[108] Since this was written, a new agrarian code has been approved, the effects of which cannot yet be evaluated at this early date.

[109] Eckstein. El ejido colectivo. op. cit. p. 65.

[110] Leyes y Códigos. Código Agrario. op. cit. Art. 76. pp. 31-32.

[111] Ibid. Art. 78. pp. 32-33.

especially for the 1971-75 period when the rate of increase is projected to drop to 1.1 percent annually (Table 2.1). Eckstein takes exception to these estimates, feeling they are too conservative[112]. However, based on the most recent calculations of Tamayo[113], there are 29.3 million cultivable hectares available, of which 23.8 million were already incorporated into holdings by 1960[114]. This would leave a land reserve of 5.5 million hectares which could be opened to cultivation.

The highest estimate encountered suggests a maximum of 37 million cultivable hectares. However, this estimate considers any land suitable for cultivation it it is within acceptable aridity standards, and as long as the gradient is less than 25 percent[115]. Moises T. de la Peña reduces this 37 million figure to 25 million after correcting for eroded or easily erodable areas, rocky lands, etc.[116]. Taking Tamayo's figures as an optimistic compromise and accepting the Secretaría de Agricultura projected rate of increase, by 1975, 98 percent of total available land would be incorporated into holdings[117]. It would appear difficult to

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[112] Eckstein. El marco macroeconómico. op. cit. p. 51.

[113] Cited in Secretaría de Agricultura et al. Proyecciones. op. cit. p. 101.

[114] Secretaría de Industria y Comercio. Cuarto censos agrícola. Resumen general. op. cit. p. 1.

[115] Secretaría de Agricultura et al. Proyecciones. op. cit. p. 106, also see Venezian and Gamble. op. cit. p. 50.

[116] T. de la Peña. op. cit. p. 432 and p. 437.

[117] Secretaría de Agricultura et al. Proyecciones. op. cit. p. 97.

hope for a higher rate of increase in cultivable area than these figures.

Possibilities for increasing the present land base through hydraulic resource development appear more promising (see Table 2.7). Of an estimated 11.2 million hectares of potentially drainable and irrigable land only 3.6 million or 32 percent was considered developed as of 1960. Potential for development of land through subsurface water and flood control is especially great, with less than 10 percent having been completed.

Table 2.7. Estimated hydraulic resource development potential[a]

| Type of development | Total surface potential (million hectares) | Percent developed (1960) | Remaining surface potential (million ha.) |
|---|---|---|---|
| Irrigable by surface water | 5.0 | 60 | 2.0 |
| Irrigable by subsurface water | 3.0 | 20 | 2.4 |
| Requiring flood control or drainage | 3.2 | -- | 3.2 |
| Total | 11.2 | 32 | 7.6 |

[a]Source: derived from data in Secretaría de Agricultura *et al.* Proyecciones. *op. cit.* pp. 101-103.

Unfortunately, increasing salinity problems affecting some 8 percent of the total irrigated surface will divert large sums from the Hydraulic Resource budget which otherwise would have been available for new projects[118].

Location of the estimated 5.5 million hectare reserve of cultivable land can be summarized as follows: The Gulf and Southern Pacific regions contain 48 percent, North and Northern Pacific regions 34 percent, and the Central Region the remaining 18 percent[119]. Significantly, the cultivable land reserves are concentrated in precisely those areas of higher idle land.

Hydraulic development possibilities include 2.0 million hectares of surface irrigation. One half of this is estimated to be in the North, 40 percent in the Northern Pacific, and only 10 percent in the Central Region. The entire 3.2 million hectares of flood control and drainage area are found in the Gulf and Southern Pacific Regions[120]. Again, the areas of greatest hydraulic development potential are found where idle land is highest[121].

In attempting to relate potential cultivable land to land needs, a measurement which shall be termed "landless peasant equivalents", or "LPE's" is used. This measure indicates the number of landless peasants

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[118] Secretaría de Agricultura _et al_. Proyecciones. _op_. _cit_. p. 102.

[119] _Ibid_. p. 103.

[120] _Ibid_. p. 103.

[121] With regard to subsurface irrigation, location is largely undetermined. In fact, apparently little is known about the extent of such resources. However, the Secretaría de Agricultura study considers the possibilities limited, largely due to the costs which are estimated to be at least double those of surface water development. See _ibid_. p. 103.

which could be provided with the "minimum legal size" (used for ejido grants) of 10 hectares irrigated or humid land, or 20 hectares of seasonal land (or any combination thereof)[122]. To err on the optimistic side, it is assumed the available cultivable land yet to be incorporated into holdings contains 40 percent of the potentially irrigable or humid lands. Based on this assumption, it is estimated that potentially cultivable seasonal lands would provide 165,000 LPE's and hydraulic development of presently cultivated and potentially cultivable land could provide 220,000 and 270,000 LPE's respectively for a total of 655,000 LPE's available to Mexico (see Table 2.8).

Table 2.8. Determination of total landless peasant equivalents (LPE's) available for future development in Mexico

| | Cultivable lands (million hectares) | Hydraulically developable lands (million hectares) | Potential LPE's |
|---|---|---|---|
| Total available | 29.3 | 11.7 | |
| Presently incorporated into plots | 23.8 | 4.1 | |
| To be developed | 5.5 | 7.6 | |
| unincorporated lands with hydraulic development potential | | 2.2 | 220,000 |
| unincorporated seasonal lands | 3.3 | | 165,000 |
| incorporated seasonal lands with hydraulic development potential | | 5.4 | 270,000 |
| | | total | 655,000 |

[122] See page 51 for an earlier discussion of this legal provision.

b. Land requirements This section estimates total land required to provide landless peasants and minifundio holders with the "minimum legal size" of holding defined above. According to the 1960 Agricultural Census, 74,000 ejidatarios have "derechos a salvo"--recognized rights to lands as soon as it "becomes available". These ejidatarios must remain in agriculture, working in the ejido to maintain their first preference in land distributions[123]. Apart from these ejidatarios, numerous other peasants have "lesser rights" to new ejido land if it becomes available[124]. To these could be added all other landless peasants who have heard numerous times the promise of a farm plot for each farm worker[125].

In 1960, there were 1,597,691 ejidatarios (Table 2.9). Included are nearly one-quarter million with holdings in excess of 10 hectares,

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[123] Leyes y Códigos. Código agrario. op. cit. Art. 153. pp. 58-59.

[124] Ibid. Art. 153. pp. 58-59.

[125] A somewhat restrained example is found in former President Gustavo Diaz Ordaz's Presidential Report of 1968: "We would like that each one could receive a plot of land; but there are regions where each year, it becomes more difficult to encounter land subject to expropriation. (Yet) when it is publicly declared that in some region the available land (for redistribution) is used up, this in no way implies that we intend to abandon, even in that region, this first step in the Agrarian Reform. We shall continue earnestly to find, even there, areas that can be given to serve the ejidatarios...." (see Aspectos economicos del informe presidencial. Comercio exterior. vol. 18. no. 9. Sept. 1968. pp. 761-780. p. 764.). A more typical statement is reported by his predecessor, Lopez Mateos, in announcing the intention of his administration "to intensify the agrarian program and the distribution of land until every landless peasant has received a plot of his own." (emphasis added). See U.S.D.A. Land redistribution in Mexico. Economic Research Service. Foreign report no. 39. 1962. p. 1.

which would exceed the legal minimum if all were irrigated. For the purpose of this study, all of this "excess land" is considered available for meeting LPE's, even though in reality these lands can not be redistributed. For example, if an *ejidatario* had 15 hectares of irrigated land, 5 hectares are considered available to fill other *ejidatarios'* land needs.

On this basis, total *ejido* land--irrigated and seasonal, meets requirements for some 609,693 LPE's (see Table 2.9). In addition, some 476,054 hectares of cultivable land are held as private property by *ejidatarios*. If half of this were irrigated (a most generous assumption), this would provide an additional 35,705 LPE's for a total of 645,398 LPE's. From the total of 1,597,691 *ejidatarios*, this leaves a deficit of 952,293 LPE's presently not being met. Undoubtedly this figure underestimates the seriousness of the actual situation due to the inclusion of *ejido* land over the minimum size and the high number of LPE's considered filled through private holdings of *ejidatarios*.

The situation of private holdings of under five hectares is easier to establish. All are obviously *minifundios*, and data is available on number of holders and type of land. The most severe land needs are found in this group. With average holdings of only 1.5 hectares, some 823,491 LPE's would be required to provide the 899,108 farmers with the additional land they need to reach the minimum legal size.

Estimates for private holdings over five hectares are harder to derive due to lack of information on amount of irrigated cultivable surface. It is again assumed that one-half of the cultivable land is

Table 2.9. Determination of landless peasant equivalents required and presently unfilled, by tenure class

| | Required LPE's | Hectares presently incorporated into plots | LPE's filled | Remaining LPE deficit |
|---|---|---|---|---|
| Ejido | | | | |
| ejidatarios with <u>derechos a salvo</u> | 73,895 | | | |
| ejidatarios with private property | 288,100 | | | |
| "pure" ejidatarios | 1,235,696 | | | |
| total irrigated and humid land | | 1,864,609 | 186,461 | |
| total seasonal land | | 8,464,638 | 423,232 | |
| total ejido held private property assuming 50 percent irrigated | | 476,054 | 35,705 | |
| total | 1,597,691 | | 645,398 | 952,293 |
| Small private holdings | | | | |
| total small holdings | 899,108 | | | |
| total irrigated and humid land | | 243,334 | 24,333 | |
| total seasonal land | | 1,025,687 | 51,284 | |
| total | 899,108 | | 75,617 | 823,491 |
| Large private holdings (5.1-10 hectares only) | | | | |
| total "larger" holdings | 94,319 | | | |
| total irrigated (assume 50% of total) | | 339,456 | 33,945 | |
| total seasonal | | 339,456 | 16,973 | |
| total | 94,319 | | 50,918 | 43,401 |
| Agricultural laborers | | | | |
| total estimated number | 3,000,000 | | | |
| less landowners and previously counted | -73,895 | | | |
| total | 2,326,105 | none | none | 2,326,105 |
| Total | 4,917,223 | | 771,933 | 4,145,290 |

irrigated or humid for holdings between 5 and 10 hectares. Holdings over 10 hectares are considered as irrigated and thus above the legal minimum size. The high irrigation assumption again introduces a bias which underestimates the problem of undersized holdings, yet an additional 43,401 LPE's to be filled are found in this category.

Eckstein has estimated that there are approximately three to three and one half million farm workers, of which some 600,000 are land owners. For the present study, the smaller figure is used so the bias will again underestimate the problem of undersized holdings. Subtracting the land holders and ejidatarios with derechos a salvo from this farm worker figure, an additional 2,326,105 LPE's are left to be filled. A summary of the required LPE's is presented in column four of Table 2.9. The total of 4,145,290 unfilled LPE's is deliberately a conservatively biased estimate. Yet, it indicates the need for 41 million hectares of irrigable land or 83 million hectares of cultivable seasonal land.

When the potentially available new LPE's (Table 2.8) are subtracted to presently required LPE's (Table 2.9), the amount of LPE's which could not be met (either now or in the future by land development) is found (Table 2.10). The result is a deficit of nearly 3,500,000 LPE's. This means some 35 million hectares of irrigated land or 70 million hectares of seasonal land over and above foreseen future possibilities are needed immediately to meet the needs of the landless and minifundistas. These needs are far beyond even the wildest estimates of total available irrigable or cultivable land. In addition, biases are deliberately built-in which underestimate the seriousness of the problem on both

Table 2.10. Determination of unfillable deficit landless peasant equivalents

| | Remaining LPE deficit | Potentially available LPE's | Deficit |
|---|---|---|---|
| Ejido | 952,293 | | |
| Small holdings, private under five hectares | 823,491 | | |
| "Large" holdings, private, 5.1-10.0 hectares | 43,401 | | |
| Landless campesinos | 2,326,105 | | |
| Incorporated, potentially irrigable | | 270,000 | |
| Unincorporated, potentially irrigable | | 220,000 | |
| Unincorporated, seasonal | | 165,000 | |
| Total | 4,145,290 | 655,000 | 3,490,290 |

the available and required LPE sides. Even disregarding the landless peasants, a deficit of 11 1/2 million irrigated hectares remains which apparently cannot be met.

The difficulty encountered in meeting land requirements in Mexico is seen in the fact that total land owners increased only 17 percent from 1940-60, while the agricultural labor force increased nearly 60 percent over the same period.

The above estimates were based on the 1960 situation. Between 1960 and 1975, it is estimated the economically active agricultural population will have increased 1.7 million[126]. Even if the non-agricultural sector could maintain the present optimistic projected annual rate of increase of 5.1 percent in its economically active population, the absolute number in agriculture would not begin to decrease until 1985[127]. At that time, the economically active population in agriculture will have surpassed nine million compared to the six million on which the above estimates are based.

As a final indication of land availability problems, it should be pointed out that the standard set nearly 20 years ago may not be adequate for the present or future. Average size of cultivable holding for the nation, has increased steadily from 6.67 hectares in 1940 to 9.10 in 1960 (see Table 2.11). The number of minifundio holdings (under five hectares) has decreased as a percentage of total holdings, dropping from 36 percent in 1940 to only 29 percent in 1960, while holdings over five hectares have increased from 10 percent to 14 percent over the same period. There has been a consistent increase in average size of holding in all categories except a slight drop from 33.40 to 32.66 hectares between 1950 and 1960 for the larger private holdings. The overall picture is one of increasing size of plots.

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[126] Eckstein. El marco macroeconómico. op. cit. p. 148.

[127] Ibid. pp. 167-168.

Table 2.11. Number of holdings, percent of total number of holdings and average cultivable land per holding, by tenure class. 1940, 1950 and 1960.

| | 1940 | | | 1950 | | |
|---|---|---|---|---|---|---|
| | Number of holdings (thousand)[a] | % of total holdings[b] | Cultivable land per holding (hectares)[c] | Number of holdings (thousand)[a] | % of total holdings[b] | Cultivable land per holding (hectares)[c] |
| Private holdings over five hectares | 231 | 10 | 29.25 | 295 | 12 | 33.40 |
| Private holdings, five hectares and under | 800 | 36 | 1.34 | 858 | 34 | 1.49 |
| *Ejido* holdings | 1199 | 54 | 5.88 | 1356 | 54 | 6.48 |
| Total for nation | 2230 | 100 | 6.67 | 2509 | 100 | 7.95 |

[a]Eckstein. El marco macroeconómico. *op. cit.* p. 110.

[b]*Ibid.*

[c]*Ibid.* Table B-21 (page unnumbered).

Table 2.11 (continued).

| | 1960 | | |
|---|---|---|---|
| | Number of holdings (thousand)[a] | % of total holdings[b] | Cultivable land per holding (hectares)[c] |
| Private holdings over five hectares | 371 | 14 | 32.65 |
| Private holdings, five hectares and under | 757 | 29 | 1.68 |
| *Ejido* holdings | 1491 | 57 | 6.93 |
| Total for nation | 2619 | 100 | 9.10 |

The preceding discussion presents a vivid description of the land crisis confronting Mexico. With present and projected levels of population and estimates of land resource reserves, it appears impossible to meet the minimum legal size goal for the agricultural worker. Even with massive expropriation, and immediate development of all cultivable and presently idle land, this goal could not be met. Thus, efficient utilization of idle land cannot solve the problem, however, it could provide an important part of the solution.

In this section, reasons have been presented contending that utilization of idle land is important to help solve agricultural problems which are accentuated by one of the most rapidly increasing populations of the world. Paradoxically, this land remains idle despite pressing dietary needs, widespread urban unemployment, and severe and apparently worsening underemployment in agriculture. The amount of cultivable land required to provide plots of "minimum legal size" would far exceed Mexico's estimated available land resources. With such prospects, even at best, utilization of idle land would provide only a partial solution to land needs. Unfortunately, more intensive use of presently cultivated lands has been largely excluded from consideration. In the desire to increase agricultural production nearly all attention has been focused on irrigation development as will be discussed in the section which follows.

C. Idle Land as an Alternative to Irrigation Development

The large reserve of idle land is especially intriguing when considered against the great governmental effort expended in trying to increase cultivable area. The importance given to irrigation development is reflected in Appendix I, Table A.6. The Secretaría de Recursos Hidráulicos has one of the largest budgets of all administrative agencies. It accounted for 20 percent of all public expenditure between 1947-58, and at present receives about 10 percent[128].

Irrigation more than any other single factor has been responsible for the great increase in cultivated area and for the transformation of Mexican agriculture[129]. Nearly 80 percent of all "agricultural" public investment has been continually allocated to irrigation[130]. This development has facilitated the new commercial agriculture typical of Northern Mexico which utilizes machinery, fertilizers, and improved seeds.

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[128] Eckstein. El ejido colectivo. op. cit. p. 98.

[129] See Venezian and Gamble. op. cit. pp. 112-113 and Lewis. op. cit. p. 316.

[130] Reliance on external sources of funds for irrigation has also been considerable. See, for example: Préstamo del BID para pequeña irrigación. Mercado de Valores. v. 28. no. 16. Nacional Financiera, S.A. México. p. 315. May 6, 1968, Créditos del BID para obras de riego. Mercado de Valores. v. 28. no. 49. Nacional Financiera, S.A. México. p. 788. Dec. 2, 1968, and Aquino, Francisco. et al. Financiamientos agrícolas del Banco Interamericano de Desarrollo. In Banco Interamericano de Desarrollo. El desarrollo agrícola de América Latina en la próxima década. BID roundtable. pp. 15-43. Washington, D. C., 1967, see especially pages 30, 34, 35, and 39.

At the same time, the emphasis on irrigation has meant that research and credit programs, extension service, promotion of more intensive land utilization in non-irrigated areas and the like, receive minimal support, since together with forestry and fishing programs, they received less than three percent of total federal expenditures (see Appendix I, Table A.6).

Despite their importance, Mexico's irrigation projects are not without their critics. The World Bank in 1953 criticized irrigation works in Mexico for showing inadequate returns, for insufficient attention placed on auxiliary distribution works, and for too little effort directed toward bettering farming methods within the irrigated areas[131]. According to Shafer, these criticisms are still valid today[132, 133].

Although the large expenditures in irrigation have made Mexico a world leader in irrigation development, there are signs of diminishing returns to these irrigation investments. Serious problems exist in efficient utilization of water within the irrigation districts. The

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[131]Reported in Shafer. op. cit. p. 90. (Original not available for examination.)

[132]Ibid. p. 90.

[133]In addition, Shafer finds a lack of planning, wherein billions of pesos have been spent for impressive appearing dams whose effects are seriously limited by failure to make the needed efforts in education and technology. Thomas Poleman, in his excellent study of the Papaloapan Irrigation Project provides substantial support for this evaluation. See Poleman, Thomas T. The Papaloapan Project. Agricultural development in the Mexican tropics. Food Research Institute. Stanford, Calif. 1964. See especially pp. 102-103 and pp. 116-120.

more favorable dam sites have probably been utilized, so that further expansion will involve substantially higher per hectare costs[134]. Interest is being expressed in small irrigation projects and in bringing irrigation to the more isolated regions[135]. Per hectare costs of such programs are higher than previously encountered[136]. Increased emphasis on non-irrigation agricultural expenditures as shown in Appendix I, Table A.6, may reflect recognition of higher returns in other areas[137]. Such a change in emphasis is in line with the Inter-American Development Bank recommendations for Latin America. The heavy investment required for irrigation projects has caused the Bank to suggest that a more logical and beneficial use of the country's scarce resources would be to improve utilization of water and land within existing irrigation systems[138]. The Bank's recommendations appear especially relevant to countries such as Mexico that have large amounts of idle land.

Impending agricultural production problems are projected in a supply and demand study of agricultural products. If irrigation is to

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[134] Poleman. op. cit. p. 28.

[135] See, Programa de inversiones en materia de irrigación para 1968. Mercado de Valores. Nacional Financiera, S.A. vol. 28, no. 4. Jan. 22, 1968. pp. 66-67.

[136] See, Créditos del BID para obras de riego. op. cit.

[137] For an indication of this change in rural development orientation, see Programa nacional de inversiones públicas en el medio rural. Mercado de Valores. Nacional Financiera, S.A. vol. 28, no. 21. May 20, 1968. pp. 345-346 and 349-350.

[138] Mitchell and Schatan. op. cit. pp. 48-49.

be emphasized, efficient use of idle land in meeting the production needs explored in the next section merits greater attention.

## D. Agricultural Production and Land Use Adjustment Problems

A careful study of supply and demand for agricultural products in 1965, 1970, and 1975, was undertaken by the Secretaría de Agricultura y Ganadería and other agencies[139]. Findings of this study, discussed below, point to rather difficult agricultural adjustment problems in the period ahead, and imply that strong demands will be made on the land resources of Mexico.

### 1. Supply and demand projections for agricultural products

a. Findings at the aggregate level It is assumed that gross national product will increase 6 percent per year over the 1960-70 period, then increasing to 7 percent between 1971 and 1975, with per capita income increasing at an annual rate of 2.7 percent. For the projected growth rate in GNP to be achieved, agricultural production would need to increase at an annual rate of 4.0 percent from 1961-70, then rise to 4.5 percent for the 1971-75 period, while industrial production increases at an annual rate of 6.9 percent and 8.2 percent for the respective periods[140].

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[139] Secretaría de Agricultura *et al*. Proyecciones. *op*. *cit*.

[140] *Ibid*. p. 13.

The study concludes that unless a greater proportion of resources are directed to the agricultural sector, the best that could be hoped for would be a 4.0 percent yearly increase in agricultural production over the 1961-70 period, then dropping to a rate of 3.3 percent for the 1971-75 period. If this were to happen, agriculture could become the critical sector in impeding the desired increase in GNP.

Furthermore, even though agricultural production for the 1961-70 period is expected to increase at the "needed" rate of 4.0 percent, internal and external demand is projected to increase at a 4.2 percent annual rate. This would mean that the 1.5 percent deficit in 1960 (largely covered by imports) would increase to 3.3 percent in 1970, and, by 1975, production would be inferior to demand by some 8.0 percent.

b. Comparison of livestock and crop sectors The most acute deficits are expected to occur in the livestock sector. A deficit of 10.9 percent in 1970 is projected to increase to 15.1 percent by 1975[141]. More discouragingly, the study expresses little hope that remedies will be found for the problems of the livestock sector.

The crop sector is expected to begin with a surplus of 1.9 percent which changes to a deficit of 2.9 percent for the corresponding periods[142]. However, closer examination reveals adjustment problems within

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[141] Ibid. p. 14.

[142] Ibid. pp. 14-15.

the crop sector may be more serious than the study indicates[143]. In addition, greater variability can be noted in the crop sector (large surpluses contrasted with large deficits), suggesting that required changes may be more specific and difficult to achieve compared to the measures needed for correcting the more uniform deficits found in nearly all livestock categories (see Table 2.12).

Supply and demand estimates for selected crops and livestock are presented in Table 2.12. In columns 1-3 the surplus or deficit is calculated as the difference between total production and demand in million pesos at constant prices. The surplus or deficit is presented as a percentage of total demand for that product in columns 4-6, and changes in these percentages over the two time period intervals are shown in columns 7-8.

The seriousness of the crop sector problems, glossed over in the original study because of favorable aggregate percentages, now becomes more apparent. Large surpluses of cereals, beans and coffee conceal the internal adjustment problems by lowering total crop deficits. Important deficits in absolute terms and as a percentage of total demand are found in the vegetable and fruit categories and in oil crops. These

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[143]For example, although the crop sector 1975 deficit is only 2.9 percent of total demand, the change in the gap between demand and supply increases to 4.8 percent of total demand, compared to an increase of only 4.2 percent in the livestock sector for 1971-75. This arises from the rate of increase in the crop sector dropping from 4.0 to 3.0 percent compared to only a 4.0 to 3.8 percent drop in the livestock sector for the corresponding 1961-70 and 1971-75 periods. See *ibid.* p. 14.

Table 2.12. Projected surplus or deficit of selected agricultural products in millions of pesos and as a percentage of total demand (1965, 1970, 1975) and net change in percent surplus or deficit between 1965-70 and between 1970-75.[a]

| | Surplus or deficit, million pesos at constant prices | | | Surplus or deficit as percent of total demand | | | Change in percent surplus or deficit between: | |
|---|---|---|---|---|---|---|---|---|
| | 1965 | 1970 | 1975 | 1965 | 1970 | 1975 | 1965-1970 | 1970-1975 |
| Cereals | 525.7 | 1025.7 | 996.3 | 7.3 | 11.8 | 9.5 | 4.5 | -2.3 |
| Legumes | 0.8 | 41.4 | 130.9 | 0.1 | 3.1 | 8.2 | 3.0 | 5.1 |
| Vegetables | -36.9 | -103.2 | -231.8 | -3.8 | -8.8 | -15.8 | -5.0 | -7.0 |
| Fruit | -223.4 | -488.6 | -989.6 | -9.4 | -16.2 | -25.8 | -6.8 | -9.6 |
| Sugar | 44.1 | -69.9 | -107.4 | 2.3 | -2.9 | -3.7 | -5.2 | -0.8 |
| Cotton | -22.7 | 196.1 | 3.5 | -0.8 | 6.5 | 0.1 | 7.3 | -6.4 |
| Alfalfa | -1.8 | -8.5 | -72.7 | -0.4 | -1.5 | -10.3 | -1.1 | -8.8 |
| Oil crops | -76.4 | -160.0 | -477.0 | -4.8 | -8.2 | -19.5 | -3.4 | -11.3 |
| Coffee | 56.6 | 161.2 | 104.9 | 6.7 | 17.1 | 9.7 | 10.4 | -7.4 |
| Beef | -234.9 | -450.6 | -839.6 | -9.9 | -14.2 | -19.3 | -4.3 | -5.1 |
| Pork | -194.3 | -471.6 | -895.1 | -11.2 | -20.3 | -29.2 | -9.1 | -8.9 |
| Milk | -160.2 | -350.0 | -619.1 | -3.6 | -6.2 | -8.8 | -2.6 | -2.6 |

[a]Source: Derived from information contained in Secretaría de Agricultura _et al._ Proyecciones. _op. cit._ pp. 16-19.

deficits become accentuated over time[144]. In view of unemployment and population pressures discussed previously, it is disturbing that such heavy deficits are found in labor intensive crops (fruits and vegetables) while increasing surpluses are found in crops of a more labor extensive nature.

In the livestock sector, critical problems are clearly evident in Table 2.12[145]. Since 92.2 percent of all available pasture was considered to be incorporated into farm plots in 1960, possibilities of opening new pasture lands are very limited. However, to the extent cultivation is deferred on presently idle lands due to marginal quality, it could still be possible to utilize such lands for livestock raising. Other possibilities for adjusting present land use in order to produce increased amounts of those crops for which deficits are foreseen are discussed in the section which follows.

2. Land resource adjustment problems

Mexico appears to be approaching the limit of cultivable and pasture land areas which can be brought into production. As of 1960, it is estimated that 81.2 percent of all cultivable land and 92.2 percent of pasture land was incorporated into farm plots (see Table 2.13).

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[144]In recent years, demand for Mexican fruits and vegetables in the United States has increased rapidly. If demand were to stabilize at present levels or were to increase, the projected deficits would be even greater than those indicated. See Secretaría de Agricultura et al. Proyecciones. op. cit. p. 204.

[145]Even if present frozen cattle exports were used domestically, the projected internal deficit would (footnote continued on following page)

Table 2.13. Incorporation of available land surface into farm plots according to land use classification. 1940, 1950, and 1960.[a]

| | Cultivable land | | Pasture land | | Forest land | |
|---|---|---|---|---|---|---|
| | million hectares | % of total available | million hectares | % of total available | million hectares | % of total available |
| Estimated total available | 29.3 | 100.0 | 85.7 | 100.0 | 66.2 | 100.0 |
| Total incorporated into farm plots | | | | | | |
| 1940 | 14.9 | 50.8 | 56.2 | 65.6 | 38.1 | 57.6 |
| 1950 | 19.9 | 67.9 | 67.4 | 78.6 | 38.8 | 58.6 |
| 1960 | 23.8 | 81.2 | 79.0 | 92.2 | 43.7 | 66.0 |

[a]Source: Secretaría de Agricultura, et al. Proyecciones. op. cit. p. 101.

Historically, an important factor increasing agricultural production has been enlargement of harvested area. In the 1927-40 period, this accounted for 79 percent of the agricultural production increase, dropping to 47 percent for 1940-50. For 1950-60, 33 percent of the increased production was still attributed to this source[146], with most of the fruit and vegetable production increase alleged to have come from area increase

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(footnote continued from preceding page) not be satisfied, leaving to one side the problem of loss in foreign currency. (See Secretaría de Agricultura, et al. Proyecciones. op. cit. pp. 18-19.) Use of presently exported live feeder cattle to fill internal demand is also limited. These feeders are raised in the North and are generally of the Hereford or Angus type, whereas the areas of possible grass fattening in Mexico are tropical, where the Zebu and Brahma strains would be required.

[146]Secretaría de Agricultura, et al. Proyecciones. op. cit. p. 98.

rather than technical advances[146a].

If the projected increases in cultivable area indicated in Table 2.1 are met, by 1975, 28.6 million hectares or 98 percent of all available cultivable land surface will be incorporated into farm plots. Possibilities of meeting livestock production needs (see previous section) are even more remote if it is to be accomplished by the traditional means of increasing pasture area, since nearly all available pasture land (92.2 percent) was already being used in 1960.

The conclusion often reached in viewing the dwindling importance of new cultivated surface and the limitations on future expansion is that new areas are becomingly increasingly costly and difficult to find. As stated by Freebairn, "it is now generally held that there are limited opportunities to increase acreage cultivated, and that most of the increased production is going to have to be obtained through more intensive use of existing lands and increasing crop yields"[147]. However, his study once more disregards the possibility of increasing cultivated acreage through utilization of idle lands[148].

To assess the possibility of utilizing available land to meet agricultural needs, the Secretarîa de Agricultura study attempts to

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[146a] Ibid. p. 137 and p. 139.

[147] Freebairn, Donald K. The dichotomy of prosperity and poverty in Mexican agriculture. Land Economics. vol. 45. no. 1. Feb. 1969. pp. 31-42, p. 34.

[148] It is doubtful that the "intensive use of existing lands" phrase was meant to include the idle land problem.

convert crop surpluses and deficits to a land equivalent basis[149]. It is disquieting that the "excess" land area drops from 665,000 to 285,000 hectares in the short five year period between 1971-75. However, any such conversion of surplus crop land to deficit crop production would be most difficult[150]. In general, the deficit crops are much more exacting in land and climate requirements. Land dedicated to the traditional, subsistence crops of corn and beans would also be difficult to convert for sociological reasons. Together, such corn and bean land occupy approximately 62 percent of the "surplus crop area". A final obstacle to conversion of rice, corn, bean and wheat surplus lands is found in the price support system. Other means of income transfer will have to be employed if the government desires to decrease the area dedicated to these price supported crops[151].

Confronted with limitations in bringing new cultivable and pasture lands into agricultural production and with the difficulty in converting surplus crop areas to the production of deficit crops, an important

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[149] Secretaría de Agricultura, et al. Proyecciones. op. cit. pp. 24-25.

[150] For example, approximately 40 percent of the "surplus" crop area is occupied by corn (considered to be more or less in equilibrium in an earlier section of the study). If "excess" corn land is subtracted, available land for crop adjustment drops from a surplus of only 195,000 hectares in 1970 to a deficit of 3,000 hectares in 1975.

[151] Although price supports may help some marginal producers, their effectiveness as a means of income transferral can be questioned since an important segment of the agricultural population consists of subsistence farmers largely outside the influence of national markets. Freebairn estimates 60 percent of the population to be non-participants in the national market. See Freebairn. op. cit. p. 32.

alternative could be offered by efficient use of idle land. As with previous studies, the Secretaría de Agricultura study disregards the idle land problem. Although acknowledging that only 56.3 percent of the cultivable lands were actually cultivated in 1960 the study concludes the idle lands were unused due to "lack of rain, lands left unplowed, seasonal suspension of agricultural activities by the owner, etc."[152]. It seems unwise to dismiss such a significant land resource in this superficial and unsubstantiated manner[153].

Utilization of idle lands could provide increased production of those crops for which deficits are presently projected, and could help relieve the acute livestock production problems foreseen. As indicated in the previous section, such programs could be more remunerative than the alternative investments in colonization or irrigation[154].

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[152] Secretaría de Agricultura _et al_. Proyecciones. _op_. _cit_. p. 99-101.

[153] "Lack of rain" would usually be reported in the "crop loss due to drought" census category. "Plowed lands" would not ordinarily be left plowed for the full year, and if so, would likely be considered part of a rotation scheme, rather than placed in the "for other reasons" idle land category. "Seasonal suspension of agricultural activities by the owner" contradicts the definition of idle land requiring land to have been left idle the entire agricultural year (see Chapter I for idle land definitions). To its credit, the study does recognize the importance of regaining fertility in the tropical areas, and the population concentration in the Central Region as possible explanations for higher and lower amounts respectively of idle land. See Secretaría de Agricultura _et al_. Proyecciones. _Op_. _cit_. p. 101.

[154] Cyprus provides an example outside of Latin America of such a government program. There, lands were left idle due to the traditional belief that increased soil fertility would result. Government programs utilized this belief to actually increase fertility by encouraging planting of nitrogen fixing legumes in a rotation scheme. Information from Panagides, Daphnis. Personal communication. 7/10/69.

It is informative, and perhaps not too far afield from the central theme of this study, to consider the potential importance of idle land to other lesser developed countries of Latin America. In the section to follow, evidence is offered which suggests an understanding of the Mexican idle land problem has applicability beyond the confines of Mexico, since idle land appears throughout Latin America.

### E. Idle Land Problems in Latin America

Idle land is not a problem unique to Mexico. Mitchell and Schatan report that Latin America is utilizing its land poorly. Of an estimated one and one-half billion hectares of agricultural and forest land in Latin America, some 538 million hectares are considered capable of cultivation. Yet only 30 percent is actually cultivated, the remaining 70 percent being left in natural pastures or "_in extensions not utilized in any form_"[155].

Between country comparisons are difficult since cultivable land definitions vary. Nonetheless, based on "many land studies in recent times," Mitchell and Schatan are convinced that huge extensions of land not presently cultivated could produce high returns. A "prudent calculation" suggested is that at least half of the cultivable but not cultivated lands could be utilized in annual crops, orchards and other permanent crops, or improved pastures[156]. If so, this would involve

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[155] Mitchell and Schatan. _op. cit._ p. 65. (emphasis added).

[156] _Ibid._ p. 65.

approximately a quarter of a billion hectares of "idle" land!

As specific examples, Mitchell and Schatan indicate that the eastern slopes of Columbia and Venezuela contain zones with cultivable but uncultivated areas probably greater than some of the large agricultural states in the Midwest of the United States. Preliminary studies in various parts of the temperate zones of Brazil, Argentina and Paraguay indicate even greater extensions of lands offering attractive possibilities for utilization at reasonable costs. In Chile, striking opportunities for improved land utilization are mentioned. Nearly two-thirds of the cultivable land area is presently dedicated to natural, unimproved pastures. Even worse, of the nearly 1.4 million "irrigated" hectares, more than one-third is dedicated to unplowed natural pastures[157]!

The situation in Peru has similarities with the Mexican case. Idle land is reported in the census, but little is known about its nature. Of a total of 3,882,883 cultivable hectares, only 54 percent are actually cultivated. Of the remaining "idle land" (46 percent), one quarter is left plowed for the year with no explanation given for the remaining three-quarters[158].

In Central America, the Guatemalan census also indicates an idle land problem (see Table 2.14), although the incidence appears to be

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[157] Ibid. pp. 66-67.

[158] Reported in Vigues, Enrique R. La reforma agraria como instrumento para el desarrollo económico en la Sierra Central del Perú. Programa Iowa--Perú. Estudio no. 1. Jan., 1967. pp. 9-15.

somewhat lower than Mexico's[159]. The Guatemalan census provides valuable information on idle land since five different sizes of holding are considered, rather than the two of the Mexican census.

Table 2.14. Land utilization in Guatemala, by size of holding and region, 1964[a]

| | Size of holding (hectares) | | | | |
|---|---|---|---|---|---|
| | under 0.70 | 0.70 to 6.99 | 6.99 to 45.13 | 45.13 to 902.51 | over 902.51 |
| Percent of cultivable area which is: | | | | | |
| seeded to annual crops | 88.0 | 75.8 | 48.4 | 33.2 | 24.8 |
| planted in trees and permanent crops | 8.9 | 7.3 | 10.3 | 39.3 | 36.9 |
| idle or fallow | 3.1 | 16.9 | 41.3 | 27.5 | 38.2 |
| Coastal region | 0.9 | 7.6 | 29.4 | 13.6 | 20.8 |
| Central region | 3.8 | 18.4 | 45.0 | 36.7 | 58.9 |
| Peten region | 14.3 | 18.1 | 49.9 | 62.9 | ---- |

[a]Source: data contained in Fletcher, et al. op. cit. pp. 29-36.

For all regions of Guatemala the amount of cultivable land left idle follows a similar pattern with regard to farm size. An increasing proportion of idle land is encountered as one moves from small (0.70 hectares

[159]Information on Guatemala in taken from Fletcher, Lehman B., et al. Agricultural development and policy in Guatemala. Report prepared for the Guatemalan Mission of USAID. Iowa State Univ., Ames, Iowa. Dept. of Economics. April 1969. manuscript. See Chapter 4, pp. 27-37.

and less) to medium (7 to 45 hectares) sized farms, the proportion then decreasing with large holdings (45-902 hectares), then increasing again in very large farms (over 902 hectares)[160].

The higher proportion of idle land in the medium sized farms is intriguing. If the "ideal" is a movement from minifundio and latifundio holdings to those of medium size, it would appear imperative to ascertain why they have higher proportions of idle land.

From the above discussion it is evident that cases similar to that of Mexico are found throughout Latin America. Although each country undoubtedly has its own unique set of economic and sociological variables which determine the nature and magnitude of its idle land problem, it is believed that the findings for Mexico may be of help in identifying certain common variables and in suggesting similar remedial actions associated with those common variables.

In this chapter, the potential importance of idle land to the development of Mexico has been examined in a number of ways. Political instability originating from land hunger has been characteristic of Mexico's history, and there are signs this desire for land could again bring unrest.

A number of problems associated with population increase are

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[160] The Peten region deviates slightly from this pattern for the large farms, however, only 25 large farms and two very large farms were reported in this region. Fletcher, *et al.* *op. cit.* p. 36.

discussed in the context of demands being placed against existing land resources. The population explosion in Mexico shows little sign of subsiding. This makes the tasks of providing an adequate diet and curbing the unemployment problems even more difficult. Employment opportunities in agriculture appear to be worsening at the same time that increasing employment difficulty is evident in the non-agricultural sector. Yet the rapid migration from rural to urban centers continues, bringing with it poor living conditions and expensive public service needs. Persistent (if not overwhelming) minifundio and landless peasant problems as seen in the wide disparity between available land and land needed for adequate sized holdings, emphasize the urgency of efficient land use.

Diminishing returns to irrigation projects indicate the need of other alternatives for increasing agricultural production. Efficient utilization of idle land provides such an alternative means of achieving more intensive use of cultivable lands.

Supply and demand projections indicate difficult adjustments will be required in agricultural production to meet the population needs. Not only is there a need for directing more resources towards the agricultural sector, but also for more efficient use of existing resources. Leaving cultivable land idle does not appear to be an efficient utilization of resources.

Finally, there are indications that idle land not only impedes the economic development of Mexico, but is a widespread problem throughout Lation America. Results of the present study may be important in facilitating examination of similar land use problems in other countries.

In this chapter we must conclude that if idle land is found to the extent indicated in the census, it seriously impedes the economic development of Mexico. The extent to which idle land actually exists in Mexico is the subject of the next chapter.

# III. DELIMITATION OF THE IDLE LAND PROBLEM

Objective one of this study was to determine the extent to which idle land is a strategic problem within the agricultural sector of Mexico. To accomplish this, the first step was to examine what the importance of idle land could be, if in fact it existed (Chapter II). The critical need for increased agricultural production was demonstrated. Efficient utilization of idle lands could offer an extremely important means of achieving this, although it is just one of a number of alternatives. However, to this agricultural production problem must be added the needs and wishes of the low income peasants, foremost among which is often the desire to be able to work their own lands. Here the possible role for idle-land utilization becomes even more dominant, since alternatives are fewer in number. Given this potential role for idle land, the magnitude of the actual idle-land problem must next be determined to complete the first objective of the study. This is done in two ways in Chapter III: First, by evaluating census data, then by examining earlier findings on the subject.

## A. Census Indications of the Extent of Idle Land

In attempting to evaluate the actual situation with regard to the amount of idle land found in Mexico, reliance must be placed chiefly on census data. This is due to the paucity of empirical information on the subject. Ever since the first Mexican Agricultural Census of 1930, the percentage of idle land reported has been surprisingly stable (see Table 3.1). Based on these figures, the idle-land problem appears great both in magnitude and persistence.

Table 3.1. Total idle land in Mexico[a]

| Year | Total cultivable land | Total idle land | Cultivable land left idle |
|---|---|---|---|
| | (million hectares) | (million hectares) | (percent) |
| 1930 | 14.6 | 7.4 | 50.9 |
| 1940 | 14.9 | 6.2 | 41.7 |
| 1950 | 19.9 | 9.1 | 45.7 |
| 1960 | 23.8 | 10.4 | 43.8 |

[a]Source: Mexican Agricultural Census. Resumen general for 1930, 1940, 1950, and 1960.

The great increase in cultivable land which has been so important to increased agricultural production (further described in Chapter II) is again apparent in Table 3.1. Cultivable land has increased from 14.6 to 23.8 million hectares. However, this increase has been accompanied by a nearly proportionate increase in land left idle, from 7.4 to 10.4 million hectares over the thirty year period. Throughout the period of census reporting, idle land has remained very close to 45 percent of the total cultivable land area. This large reservoir of idle land supports the earlier contention that although much effort has been expended in opening new lands to cultivation, little has been done to encourage more intensive utilization of these lands.

It would appear reasonable to hypothesize that the three million hectare increase in idle land over the 30-year period is contained in the cultivable land increase, rather than land which was originally cultivated in 1930 but subsequently abandoned in favor of the newly opened areas[161].

In Table 3.2, idle land is calculated as a percentage of cultivable land by state and region and by land tenure class for 1950 and 1960. Examination of the changes in percent idle land between 1950 and 1960 reveals a surprising degree of stability for the two time periods by state and region. One exception is the Northern Pacific region, where all states had less idle land, resulting in a drop from 52.9 to 39.3 percent between the two periods. A large amount of this drop can be accounted for by the state of Sonora, which experienced a decrease from 64 percent to only 35 percent idle land--the greatest change for any state or territory.

In other regions, small decreases of idle land in some states were offset by small increases in other states. Although states within the same region often have different amounts of idle land, the changes within the states themselves are quite small over time. It would be difficult

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[161]To the extent this is true, expected benefits of new projects opening land to cultivation should not be evaluated in terms of potential production of the total hectares incorporated. A more appropriate measurement of benefits would include consideration of hectares to be cultivated net of those which will be left idle. Costs required for bringing these idle lands into cultivation must be added to other project costs before benefits over the entire cultivable area are valid. In the author's belief, it is extremely unlikely this has ever been considered in project evaluation in Mexico.

Table 3.2. Idle land as a percentage of total cultivable land by state (or territory) and region and by land tenure class, 1950 and 1960[a]

| Region or state (territory) | Total | | Private holdings over five hectares | | Private holdings five hectares and under | | *Ejido* holdings | |
|---|---|---|---|---|---|---|---|---|
| | 1950 | 1960 | 1950 | 1960 | 1950 | 1960 | 1950 | 1960 |
| North | 37.01 | 39.46 | 41.71 | 42.79 | 29.83 | 41.06 | 32.14 | 34.92 |
| Coahuila | 50.29 | 61.75 | 53.91 | 66.03 | 44.40 | 46.64 | 47.13 | 57.62 |
| Chihuahua | 27.64 | 40.65 | 26.17 | 42.37 | 13.27 | 27.28 | 30.53 | 38.29 |
| Durango | 27.14 | 36.96 | 30.01 | 44.14 | 13.75 | 31.65 | 25.02 | 25.64 |
| Nuevo Leon | 54.59 | 47.78 | 62.16 | 48.17 | 34.74 | 46.61 | 35.65 | 47.07 |
| San Luis Potosi | 32.70 | 47.05 | 34.25 | 48.83 | 32.19 | 43.89 | 31.96 | 46.03 |
| Tamaulipas | 37.83 | 29.96 | 39.46 | 34.71 | 36.62 | 48.94 | 35.84 | 19.28 |
| Zacatecas | 35.32 | 21.03 | 42.70 | 25.64 | 32.89 | 44.05 | 25.90 | 14.95 |
| Gulf | 63.21 | 57.19 | 73.88 | 63.60 | 41.77 | 51.02 | 52.09 | 43.70 |
| Campeche | 90.55 | 85.44 | 91.36 | 87.55 | 28.28 | 76.68 | 90.23 | 82.17 |
| Quintana Roo | 84.43 | 89.50 | 88.52 | 95.16 | 19.67 | 65.98 | 65.74 | 62.41 |
| Tabasco | 61.75 | 55.70 | 64.55 | 55.68 | 41.86 | 53.69 | 60.19 | 56.02 |
| Veracruz | 42.69 | 46.69 | 50.20 | 56.00 | 42.07 | 49.38 | 35.87 | 36.25 |
| Yucatan | 68.58 | 54.87 | 85.69 | 72.73 | 42.66 | 63.20 | 47.84 | 36.81 |
| North Pacific | 52.90 | 39.33 | 60.66 | 39.53 | 26.18 | 32.94 | 41.80 | 39.24 |
| Baja California | 34.77 | 32.90 | 33.27 | 28.03 | 18.21 | 73.06 | 36.96 | 40.50 |
| Baja California, Sur | 79.56 | 66.90 | 87.12 | 67.67 | 34.92 | 48.58 | 62.30 | 64.51 |
| Nayarit | 51.78 | 44.36 | 70.64 | 53.50 | 15.30 | 34.37 | 42.67 | 39.89 |
| Sinaloa | 46.82 | 41.94 | 45.16 | 36.28 | 30.59 | 33.73 | 49.04 | 47.29 |
| Sonora | 63.63 | 34.66 | 72.18 | 40.44 | 23.97 | 28.05 | 28.48 | 21.00 |

Table 3.2. (Continued)

| Region or state (territory) | Total |  | Private holdings over five hectares |  | Private holdings five hectares and under |  | Ejido holdings |  |
|---|---|---|---|---|---|---|---|---|
|  | 1950 | 1960 | 1950 | 1960 | 1950 | 1960 | 1950 | 1960 |
| South Pacific | 58.93 | 56.25 | 65.91 | 61.73 | 21.94 | 25.79 | 55.02 | 53.52 |
| Colima | 51.36 | 35.89 | 47.92 | 30.85 | 36.85 | 34.04 | 55.48 | 41.49 |
| Chiapas | 56.84 | 48.97 | 60.18 | 41.04 | 44.36 | 45.92 | 54.44 | 54.16 |
| Guerrero | 69.06 | 58.98 | 79.55 | 65.05 | 24.19 | 23.64 | 46.86 | 51.64 |
| Oaxaca | 48.71 | 60.78 | 50.18 | 69.27 | 17.26 | 23.70 | 65.93 | 58.19 |
| Centro | 32.14 | 32.09 | 32.02 | 36.58 | 29.21 | 29.74 | 32.86 | 29.05 |
| Aguascalientes | 24.79 | 27.64 | 11.26 | 15.21 | 23.15 | 30.49 | 32.02 | 32.04 |
| Distrito Federal | 19.05 | 19.08 | 13.14 | 13.34 | 13.99 | 12.51 | 29.03 | 31.19 |
| Guanajuato | 31.03 | 30.63 | 29.92 | 32.66 | 25.56 | 39.87 | 32.47 | 27.89 |
| Hidalgo | 33.01 | 27.11 | 18.58 | 19.55 | 49.79 | 46.53 | 34.40 | 25.36 |
| Jalisco | 40.75 | 38.50 | 39.68 | 41.43 | 41.42 | 45.58 | 42.05 | 34.17 |
| Mexico | 23.81 | 22.79 | 27.06 | 30.56 | 16.87 | 21.82 | 25.24 | 19.50 |
| Michoacan | 36.02 | 38.68 | 38.69 | 49.37 | 28.73 | 36.72 | 36.37 | 31.37 |
| Morelos | 43.44 | 44.46 | 54.82 | 44.52 | 36.07 | 36.02 | 42.22 | 45.58 |
| Puebla | 22.13 | 28.99 | 18.42 | 31.61 | 29.20 | 23.52 | 20.27 | 29.54 |
| Queretaro | 41.21 | 36.74 | 32.72 | 42.94 | 37.92 | 37.34 | 46.07 | 32.71 |
| Tlaxcala | 13.48 | 8.94 | 17.94 | 10.05 | 9.26 | 12.47 | 12.69 | 7.25 |
| Total for nation | 45.70 | 43.80 | 53.01 | 49.98 | 28.85 | 32.35 | 39.72 | 37.96 |

[a]Source: Compiled from data contained in the Mexican Agricultural Census. Resumen general for 1950 and 1960.

to establish any clear-cut regional pattern based on this information, either for 1950 or 1960. This is demonstrated by the fact that neighboring states with similar weather and geography often have quite distinct levels of idle land.

An examination of the differences between tenure classes shows considerable variation within states for the two time periods. In part, it is this variation among land tenure classes which stimulated interest in studying the influence of land tenure on idle land. Within any tenure class, however, the variations by state between 1950 and 1960 are fairly small. Of the three tenure classifications, the ejido is especially stable, both between states and over the two time periods. In the greater-than-five-hectare category, Sonora is again the outstanding exception, with idle land dropping from 72 percent to only 44 percent of total cultivable area. In fact, it is now seen that this change in the greater-than-five-hectare category is the chief contributing factor to the large decrease for the state mentioned earlier[162].

The greatest variation over time is found in the less-than-five-hectare category, with notable changes (increases) seen in Campeche, Quintana Roo, Yucatan, Baja California, and Nayarit. However, in each case, the amount of land involved in such holdings is quite small, less

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[162]The same can be said for the region as a whole. The decrease in idle land in the Northern Pacific region can be attributed to decreases in idle land in the holdings over five hectares, while those of less than five hectares and the ejido holdings contributed little or nothing. It would be interesting to determine what factors have contributed to this decrease in idle land among the larger land holdings.

than 7,000 hectares. Thus, small absolute changes could give rise to the large percentage changes noted.

For the *ejidos* idle land decreased in all regions except the North. For holdings over five hectares idle land decreased in all regions except the North and Central. However, in the less-than-five-hectare category, every region (in fact, 24 of the 32 political subdivisions considered) had *increases* in percent idle land. And, in the eight states where idle land was reduced, the decreases were quite small, the largest being only 5.68 percent in the State of Puebla[163].

### B. Supporting Evidence Provided by Other Studies Regarding Extent of Idle Land

Eckstein is one of few to have expressed interest in the nature of the idle-land problem[164]. A principal theoretical argument in favor of the collective *ejido* is the possibility for more optimal land utilization. However, due to insufficiency of the idle-land data, he was forced to conclude that no tests were possible to measure the difference in utilization of land between the collective and the individual *ejido*. Through

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[163]The interesting changes occurring in the less-than-five-hectare class make it unfortunate that the present study excludes this category. The exclusion is necessitated by different information collected by the census for this category, which makes it impossible to compare findings with the other tenure classes. Another justification for excluding this category is that it holds only 5.3 percent of the total cultivable land area. However, this is offset somewhat by the fact that 70.3 percent of all holdings of cultivable land are in the less-than-five-hectare category.

[164]Eckstein. El ejido colectivo. *op. cit.* p. 272.

his access to original census questionnaires, Eckstein ascertained numerous errors in observation and interpretation (often compounded in the "revisions" made on these cards before tabulation). Inconsistent treatment of the idle-land category was especially noted.

Due to Eckstein's reports regarding areas of unreliability in the 1950 census, a preliminary study was undertaken before the present one to consider the possibility that the idle-land "problem" was an unreal phenomenon arising simply from censusing errors[165]. It was felt that if a reasonable model were constructed which could explain a sizeable amount of state-to-state variation in idle land, then the argument that idle land was due simply to censusing errors could be tentatively rejected. Results of this investigation led to the conclusion that idle land was indeed a real problem, warranting closer investigation through expanded models and through study undertaken at more disaggregated levels.

Fortunately, determination of the extent of idle land is not limited exclusively to census data. A linear programming study of credit availability and requirements by Ladman in the "Tierra Caliente" region of Mexico confirmed census reports of high amounts of idle land for that region[166].

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[165]See Winkelman, Don and Hansen, David. Idle land: An anomaly in Mexican resource use. Land Economics. Vol. 47, No. 3, Aug., 1971. pp. 289-296.

[166]Ladman, Jerry Ray. The marginal value productivity of short-term credit and an examination of external credit rationing for representative farm firms in two Mexican municipios. Unpublished Ph.D. thesis. Ames, Iowa, Library, Iowa State University. 1968.

Four cases were considered by Ladman: (1) an ejidatario with 20 hectares of seasonal land, (2) an ejidatario with 10 hectares of seasonal land, (3) an ejidatario with 10 hectares of irrigated land, and (4) a private property owner with 50 hectares of irrigated land. Results for the first case are given in Table 3.3[167]. A very high marginal-value product for credit was found, due to exceptionally large returns when utilized to employ redundant land, labor, and mule power. When these are no longer redundant, a substantial drop in the marginal-value product of credit is experienced. In Table 3.3, notable decreases in the marginal-value product of credit are seen when the extensive margins of mule power, and then land use, are reached. This pattern is consistent for all levels of living expenditure considered, and similar for all four cases studied[168].

In addition to the high marginal-value product of credit in land use, it was shown that, for a given living expenditure level, a considerable movement from the "break-even" point (the first basis change showing positive savings) can be undertaken through increased use of credit and still all land will not be brought into cultivation. At the break-even level of credit use, the farmer would meet expenditure levels with zero savings, would leave part of his land idle, rely on mule power, and have redundant labor. Only when the extensive margin of land is reached does he begin to substitute tractor power, with a corresponding

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[167]Similar results were found for each case studied.

[168]Ladman. op. cit. pp. 229-234.

Table 3.3. Marginal value product (MVP) of credit at the extensive margin of land use and mule power for an ejidatario with 20 hectares of seasonal land[a]

| Living expenditure level (pesos/month) | Marginal value product of credit & credit level in pesos when, for the last time: | | | | | |
|---|---|---|---|---|---|---|
| | (1) mule power is the only power source | | | (2) all land is under cultivation | | |
| | (a) credit level | (b) MVP | (c) next MVP | (a) credit level | (b) MVP | (c) next MVP |
| 1816.63 | 11,197 | 2.299 | 1.514 | 17,823 | 0.913 | .552 |
| 1191.00 | 7,737 | 2.872 | 1.456 | 14,310 | 1.428 | .665 |
| 621.31 | 4,740 | 2.175 | 1.429 | 11,314 | 1.384 | .645 |
| 0.00 | 1,471 | 2.175 | 1.429 | 8,047 | 1.384 | .645 |

Source: Ladman. *op. cit.* p. 234.

expansion in credit needs. This pattern was similar over a wide range of living expenditure levels, and appears to be a very accurate account of the real situation in the area studied.

Under conditions of strong aversion to risk, living-expenditure levels could be protected with minimal amounts of borrowed money, and by leaving part of the land idle. It should be noted that the living expenditure levels utilized in the study could be considered higher than the usual rural Mexican case. To the extent this is true, the existence of large amounts of idle land is even further supported.

An alternative to the risk-aversion explanation for the large amounts of idle land is the possibility of external credit-rationing. Extensive credit-rationing was in fact found by Ladman. Most of the available credit was given to irrigated land, especially in the *ejido* case. Credit supply is also limited by the government sanctioning process, which channels the major portion to certain "desired" crops. In addition, banks impose quotas which are not sufficient to meet the credit needs of the farmers.

An extreme case of land underutilization occurs when the entire holding is left idle. Although it is difficult to obtain data on holdings abandoned or rented to others, a study of a number of *ejidos* undertaken by Hernandez Segura[169] suggests this phenomenon is surprisingly frequent

[169] Hernández Segura, J. Estudio de las condiciones económico agrícolas de las sociedades de Nueva Italia. Escuela Nacional de Agricultura. Chapingo, México. 1959. Cited in Eckstein. El ejido colectivo. *op. cit.* p. 196.

(see Table 3.4). In Nueva Italia (one of the better endowed _ejidos_), only 30 percent of the holdings were actually cultivated by the _ejidatarios_.

Table 3.4. Land utilization in Nueva Italia and other selected _ejidos_, 1959[a]

| | Nueva Italia _ejido_ (percentage of holdings) | Average of the four _ejidos_ studied in the region (percentage of holdings) |
|---|---|---|
| Cultivated by ejidatarios | 30 | 51 |
| Rented to others | 20 | 13 |
| Share cropped | 25 | 22 |
| Abandoned | 25 | 14 |

[a]Source: Hernândez Segura. _op. cit._

Eckstein agrees that land abandonment (and renting) of the _ejido_ and small holdings reaches considerable proportions[170]. He attributes this principally to the lack of water, whereby the irrigation quotas imposed make it inconvenient to cultivate small plots of land, which are even further reduced and fragmented by low water quotas. Thus, the practice of land abandonment is believed to be widespread throughout the country[171]. However, even under such unfavorable conditions, some may prefer to cultivate their land for fear of losing their _ejido_ rights.

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[170]Eckstein. El ejido colectivo. _op. cit._ pp. 175-176.

[171]Further discussion on land abandonment reports is found on page 45.

This suggests the amount of idle land would be even greater were it not for such legal sanctions.

In summary, evidence is found which indicates that idle land does occur, and is an important problem. However, this proposition is only tentatively accepted, since the present study is itself a further test of the genuineness of the idle-land problem.

When land is needed (see Chapter II), yet large amounts of land apparently are left idle, the problematic gap in terms of under-utilization of needed land resources becomes extremely great. Of course the dimensions of the problem depend not only on the amount of land, but also on the reasons for its being left idle, since these will determine the possibilities and costs of utilizing this land for meeting indicated needs. An examination of possible explanations of idle land is presented in the following chapter in the form of hypotheses which are subsequently tested in Chapter VI.

# IV. FORMULATION OF THE DIAGNOSTIC HYPOTHESES

In Chapter II, the existing situation was examined which indicated a pressing need for more efficient utilization of land resources, particularly idle lands. Delimitation of the idle land problem in Chapter III, based on census data and other studies, supported the proposition that idle land is found extensively in Mexico. Chapter IV proceeds with an introductory discussion of the nature and role of hypotheses and social inquiry as a necessary prerequisite to the formulation of hypotheses found to be substantiated are further examined in the context of existing success and failure elements which could be drawn upon or altered to enhance remedial action.

## A. Nature and Role of Hypotheses and Social Inquiry[172]

According to Dewey, scientific inquiry is by nature both self-developing and self-correcting. These features lead to a principle of "long run" knowledge through continual development and expansion of existing knowledge[173]. Malewski[174] points out that theoretical knowledge is not a set of infallible and absolute truths, but rather a system of

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172 Development of this section is based largely on the ideas presented in Dewey, John. The theory of inquiry. Henry Holt and Company, Inc. New York. 1938. pp. 487-512.

173 Ibid. p. 490.

174 Malewski, Andrzej. Two models of sociology. The Polish Sociological Bulletin. Vol. 1. 1962. p. 21.

hypotheses which present a challenge to other investigators, who, through modification, make them more adequate hypotheses. Hence, the process of generating knowledge within social sciences involves formation of various hypotheses offering an approximate picture of behavior and inspiring further investigation. From this point of view, a scientist's contribution does not depend on whether his hypotheses have been maintained unchanged, but rather on the role of his hypotheses in the development of knowledge.

This "continuity of knowledge" principle is apparent in the present study, which is a direct outgrowth of a previous investigation undertaken by Ladman[175]. His studies on credit needs, with somewhat tangential findings on idle land, stimulated the curiosity to explore further this idle land phenomena. It is expected that not all of the findings suggested by the present study will remain unchallenged, and it is hoped that further study concerning the causes of and remedies for idle land will be stimulated.

Dewey's pragmatic view suggests that genuine social inquiry involves developing operations which modify actual conditions. Thus, the aim and consequence of all inquiry must be the "transformation of antecedent problematic subject matter"[176]. Any notion of separation of science from the social environment is a fallacy which encourages the scientist's

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[175] Ladman. op. cit.

[176] Dewey. op. cit. p. 492.

irresponsibility for the social consequences of his work[177].

Dewey suggests the social inquirer has often assumed that existing problems are already definite in their main features, so only their solution is left to be discovered. Conversion of a problematic situation into a definitely defined problem is disregarded. This greatly contrasts with physical inquiry, where a large part of the analysis concerns determination of the nature of the problem. Any plans for remedial procedure cannot be objectively evaluated until a formulation of the problem is effected[178].

In Chapter III, an indication of the extent to which idle land actually exists was presented. Regression analysis and case study results (to be discussed later) reinforce the assertion that idle land is of frequent occurrence. In view of this information, efficient utilization of idle land would appear to offer a means to transform the problematic situation described in Chapter II. However, it is only one of many means which could be employed to achieve the ends in view implied in the existing problematic situation described earlier of desire for land ownership, adequate diets, better agricultural income, agricultural employment, etc. The desirability of utilizing idle land as a means for partially achieving these ends will depend on how well the remedial measures here advanced compare with alternative measures.

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[177] Ibid. p. 489.

[178] Ibid. pp. 493-494.

Dewey suggests that a common but fallacious belief holds that subjective evaluative procedures should be ruled out to allow conclusions to be based on facts only[179]. This desire to exclude all evaluation is due to an overreaction to moral judgments, and rests on the incorrect supposition that moral judgments are themselves evaluative. Moral judgments simply assert a preoccupation with ends that should be attained, and in fact desire to remove these ends from the field of inquiry. If this is allowed to occur, inquiry degenerates into ascertaining and manipulating the means by which the ends may be attained. The function of ends in view--which is both hypothetical and directive--is ignored, and a logical condition of inquiry is violated[180].

According to Dewey, if a problem is genuine, it must be determined by existing problematic situations. If it is not the outgrowth of actual social conditions, the "problem" is factitious and arbitrarily set by the investigator rather than being of objective origin. The delimitation of ends to be attained (ends in view) is essential to formulation and testing of hypotheses in strict correlation with the existing conditions[181]. Thus, evaluation must be utilized to determine which "problems" constitute appropriate subject matter for social inquiry.

One cannot assume the problem is already defined, nor can one assume that the facts are there simply to be observed, assembled in mass number,

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[179] Ibid. p. 495.

[180] Ibid. pp. 495-497.

[181] Ibid. pp. 497-499.

and molded into generalizations. A precondition of the selection and ordering of material as facts is a generalization in the form of a hypothesis. Competent inquiry demands that out of the mass of observable material, certain material be selected as the "facts of the case". Without this selective process, there is no guide for observation and therefore "one fact is as good as another"[182]. Such hypotheses attempting to elucidate why the problem exists can be called diagnostic hypotheses.

Dewey stresses the importance of the sequential nature of social change. A fact isolated from the history of which it is a moving constituent loses its distinctive qualities, and cannot be considered a social fact[183]. Recognition of this historical continuum is especially significant in the present study. It is essential to understand the continuing role which the desire for land ownership has played in the political processes of Mexico if the importance of efficient utilization of land resources is to be appreciated. It was this importance that led to selection of the historical role of land in Mexico's political stability as the opening section of Chapter II.

The evaluative process required for ascertaining which existing conditions are of greater importance in transforming a problematic situation depends on formulation of what can be called remedial hypotheses. In selection of remedial hypotheses to be tested, account must be taken

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[182] Ibid. p. 497.

[183] Ibid. p. 501.

of existing obstacles (failure elements) and resources (success elements)[184].

The need for formulation of remedial hypotheses is related to the ever present question: When is a hypothesis considered to be confirmed? Zetterberg suggests the following criteria[185]:

1. Validity of the indicators
2. Reliability of the indicators
3. Goodness of fit between data trend from the indicators and the trend predicted by the tested hypothesis
4. Control of alternative hypotheses
5. Representativeness of the sample and scope of the population
6. Extent to which the tested hypothesis is an integral part of established theory

Hence, even if statistical tests indicate fairly low probability levels, the result should not necessarily be rejected, but should be evaluated as to how well it fulfills the other criteria. As Zetterberg points out, "scientific advance is as hampered by the error of rejecting something true as by accepting something false"[186]. In fact, he finds that to the theorist a huge accumulation of supporting evidence is hardly more impressive than a few strategically selected cases[187].

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[184] An analytical framework for resolving land tenure institutional defects which utilizes these concepts in found in Timmons, John F. Agricultural development through modifying land tenure arrangements. In Haroldson, Edwin O., ed. Economic development of agriculture. Iowa State University Center for Agricultural and Economic Development. pp. 81-98. Iowa State Univ. Press. Ames, Iowa. 1965. see especially pp. 87-91.

[185] Zetterberg, Hans L. On theory and verification in sociology. 3rd. ed. The Bedminster Press. Totowa, New Jersey. 1965. pp. 108-110.

[186] Ibid. p. 111.

[187] Ibid. p. 154.

Zetterberg approaches Dewey's pragmatic position when he states that the precision required "must be chosen with an eye to the quality of the data submitted in its support and with another eye to the possible use of the theory in research and practice"[188]. However, Dewey is much more explicit. To him, the validity of a hypothesis cannot be determined short of the consequences to which its use gives rise. Conclusions have the status of hypotheses until agreement upon the consequences is reached[189]. This need for agreement of consequences as confirmation of a hypothesis leads easily to his position that the ultimate test of all inquiry is the transformation of a problematic situation involving confusion and conflict into a unified one[190].

Agreement of consequences may be relatively easy with physical inquiry, where the desired outcome may be reached in the privacy of a laboratory. But in the social sciences, the proposed solutions involve associated activities, and ideas and organizations which execute the operations[191]. Yet, when remedial action is taken, every policy measure put into operation can be viewed as an experiment, since it represents adoption of one out of a number of alternative possible actions, and since the consequences of its execution may serve as tests for the validity of the hypothesis acted upon.

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[188] Ibid. pp. 63-64. (emphasis added).

[189] Dewey. op. cit. p. 490.

[190] Ibid. p. 490.

[191] Ibid. pp. 502-503.

In summary, according to Dewey a problem of inquiry in social subject matter must possess three important attributes if it is to meet conditions of scientific method: (1) It must grow out of acute social needs, tensions and troubles; (2) It must have a subject matter determined by availability of means to arrive at a solution; (3) It must be related to some hypothesis which is a plan for resolution of the conflicting social situation[192].

In the second chapter, an exposition was made of social needs and problems which indicated the desirability of efficient land utilization. The third chapter examined the extent of the idle land problem. The remainder of Chapter IV suggests, in the form of diagnostic hypotheses, reasons why this problem exists. These hypotheses are tested in Chapters VI and VII. To meet the final condition of scientific method indicated above, remedial hypotheses, based on the existing success and failure elements, are formulated in Chapter VIII, presenting a plan of suggested priorities to help solve the idle land problem.

## B. Formulation of Diagnostic Hypotheses

### 1. Criteria for classification

Although it is difficult to develop a system of classification which is clear-cut in its grouping of idle land diagnostic hypotheses, it does appear reasonable to attempt a grouping based on the possibility of exerting control over the explanatory variables considered. Based on

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[192] *Ibid*. p. 499.

this criterion, the diagnostic hypotheses have been grouped into the following three categories:

(1) Those hypotheses containing variables directly controllable by the firm. These variables are viewed as being, to a large degree, within the power of the individual to control. There are instances where this may be unrealistic. As an example, capital formation may lie outside the control of the individual if there are no sources disposed to loan to certain groups of farmers because of lack of guarantees, custom, prejudice, etc. Thus, capital formation decisions depend not only on the decision to consume or to save, but also on credit availability which may rest on governmental polciy decisions lying outside the individual's control. However, in the usual case, variables in this calss would be, to a large extent, subject to the influence of the individual peasant.

(2) Those hypotheses containing variables outside the direct control of the firm. These variables are considered to be still controllable, but within the domain of a higher decision making level than the individual firm. For example, to the extent new technology is required to correct the idle land problem, it is more likely that such technology would be generated and diffused by government and industry than by the individual peasant.

(3) Those hypotheses containing largely uncontrollable variables. These variables are viewed as controllable only with great difficult or at very high costs. The control of weather conditions, proximity to urban centers, etc. would be examples. Thus, to the extent these variables explain the incidence of idle land, the problem would be extremely

difficult to remedy.

The remainder of Chapter III is devoted to an exposition of the diagnostic hypotheses which have been selected to be tested in a later chapter.

a. The diagnostic hypotheses According to the preceding criteria, those variables considered to be directly under the control of the firm are: levels of capital, labor, and technology used; degree of fragmentation of holdings; and the legal situation regarding land titles. Variables considered controllable at a higher level of decision making include: amount of irrigated land, type of land tenure system, and opportunities provided for off-farm employment. Variables difficult to control include long-term and unseasonable weather conditions, poor land quality, and census errors. Further explanation and justification for the classification in this manner is presented below.

b. Variables directly controllable by the firm

Hypothesis 1.1: As the amount of capital per cultivable hectare increases, the amount of idle land will decrease:

Much has been written about the lack of sufficient capital and credit to meet the needs of Mexican agriculture[193]. If a severe capital

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[193]An interesting case is reported by Silos in his study of the Yaqui Valley, Sonora. Between 1958 and 1963, capital held by *ejidatarios* decreased by approximately 30 percent after considerable initial emphasis by the *Ejido* Bank. The result is reported to be a much higher marginal productivity of land in the private sector than the *ejido* sector due to the greater quantity of resources, more efficient utilization of these resources, and greater employment (footnote continued on following page)

shortage is coupled to a production function which demonstrates increasing returns to capital over a part of the relevant range, then it would be completely rational for the campesino not to use all of his land. Rather, he would concentrate his efforts and his capital on part of his holdings, unless the available capital were great enough to give everywhere diminishing returns. Thus, capital would be complementary to land use, facilitating an increased use of otherwise redundant land resources.

Less attention has been given to possible credit needs and problems of the smaller private farms than those of the ejido. For this reason, Hypothesis 1.1 is tentatively advanced as applicable to both the ejido and private sectors.

Control over capital formation which the firm is able to exert is viewed as a function of the individuals' willingness to undertake indebtedness and to forego present consumption for savings and capital investment.

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(footnote continued from preceding page) of improved inputs. (Silos, J. S. El Valle del Yaqui, Sonora. Su desarrollo agrícola, utilización de recursos y potencial económico. Unpublished manuscript. ca. 1966. pages unnumbered. See also pages 90-93 for previous discussion of credit needs. Other statements regarding the need for agricultural credit are found in: Poleman. op. cit. pp. 62-63, Durán, Marco Antonio, La reforma agraria mexicana. Comercio Exterior. Vol. 18, no. 6, pp. 493-498, June 1968, p. 498, Myren, Delbert T. Integración del mercado rural a la economía nacional en México. Comercio Exterior. Vol. 17, no. 9, pp. 706-710. Sept. 1967, p. 710. See also Gustavo Díaz Ordaz's Presidential Address of 1968. in The News. Sept. 2, 1968. pp. 1-16. p. 13.

Hypothesis 1.2: As the amount of labor utilized per hectare of cultivable land is increased, the amount of idle land will decrease:

The preceding argument concerning capital could also apply to the case of labor. If increasing marginal returns to labor were encountered over part of the relevant range of the production function, it would be rational for the farmer to concentrate the available labor on part of the land area and leave the remaining land idle.

Although such an argument might appear unlikely in light of the earlier discussion of population pressures on the land resources (see Chapter II), it could be possible that at least in some regions, for short periods of time, labor scarcity could occur. Hence, the possibility of labor shortage has been included as a hypothesis for the existence of idle land.

Control over the labor variable by the firm is possible in a number of ways--the propensity to forego leisure time, the willingness to utilize family labor, and the readiness to pay higher wages to secure additional labor.

Hypothesis 1.3: As the level of technology adopted increases, the amount of idle land will decrease:

The opportunity cost of a hectare of idle land to which fertilizer, insecticides, hybrid seed, etc. could be applied, would be much higher than that same hectare wherein the benefits of such modern inputs were unknown. Thus, it is hypothesized that the amount of idle land found would be less in areas where there are indications of greater adoption of new technology than in areas of a more traditional orientation.

It is assumed that educational level is closely related to the knowledge of and adoption of new technology. Those receiving higher levels of education would also have received greater exposure to the arguments which encourage the acceptance of modern inputs.

The amount of exposure to new technology may not be entirely under the control of the firm, depending rather on governmental programs and chance. Yet, once exposed to new technology, adoption by the firm will depend largely on the individual farmer. In addition, the decision to receive more education, attend field days, etc. is considered to be largely under the control of the individual.

Hypothesis 1.4: The greater the amount of fragmentation and inaccessibility of holdings, the more likely such holdings will be left idle:

Here the prime element of importance is the time necessary to reach a given land parcel. In Mexico, it is customary to live in villages rather than next to the fields. It is supposed that more distant fields would be most likely to be left idle, especially if of poorer quality than other holdings. Production efforts would be first concentrated on the more accessible holdings.

In the case of the *ejido*, since holdings can not be sold to allow consolidation or acquisition of holdings closer to residence, such fragmentation would be largely outside of the individuals' control. However, to the extent lands can be sold or traded and to the extent the individual is willing to live next to his farm lands, the fragmentation problem would be controllable by the firm.

Hypothesis 1.5: Holdings characterized by uncertainty of title are more likely to be left idle than those with clear titles:

Land not farmed by its owner could be rented or sold if clear title were held. However, in the absence of clear title, legal complications could render sale difficult and could make it inadvisable to rent the land, due to possible subsequent legal disputes about ownership[193a]. If such a problem were found, it would be rational to retain possession, and, if unable to farm the land personally, to simply allow the land to remain idle. Furthermore, in the case of holdings with unclear title, greater difficulty would be encountered in securing credit.

It is assumed that titles could be cleared in many cases if the peasant were willing to expend the necessary money and effort. It is recognized, however, that in some instances possession of clear title might fall largely outside the control of the individual. Legal requirements and costs could be such that titles would be very difficult to clear.

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[193a]With problems in retaining possession even with clear title and without inviting renters, it is not surprising that idling of land might be preferred to land rental. Legal provisions which might be interpreted as encouraging land takeover by renters (including provisions for acquiring ownership when land is taken by violent means) are found in: Leyes y Códigos de México. Código civil para el distrito y territorios federales. 22nd ed. Art. 1151-1156. Editorial Porrúa, S.A. México 1968. pp. 242-243.

c. <u>Variables outside the direct control of the firm</u>

<u>Hypothesis 2.1: Areas of greater irrigation development will tend to have less idle land</u>:

Irrigation provides protection against the vacillations of nature and is especially important in dry areas of otherwise marginal production. The higher marginal value product of such irrigated land compared to seasonal land also arises from greater opportunities to use new technological inputs which would be less successful on seasonal land. These considerations lead to a much higher opportunity cost per hectare of irrigated land left idle than for an otherwise similar hectare of seasonal land. Thus, it is hypothesized that irrigation development is a significant factor in decreasing idle land.

If there were water available at reasonable cost, and if the credit necessary to develop water resources were available, and if the farmer were favorably disposed towards using credit for the development of such an irrigation resource, then the irrigation variable would be under the control of the individual. In actuality, little is known about underground irrigation resources, and the largest share of irrigation development has been under the auspices of government agencies. Thus, present data reflects a situation largely controlled by the government, not the individual. The test of Hypothesis 2.1, then, pertains primarily to continued government irrigation development as an explanation for differential rates of idle land, and only secondarily does it relate to possible irrigation development by individuals.

Hypothesis 2.2: Areas of heavier ejido concentration will tend to have higher amounts of idle land:

It is hypothesized that rates of idle land are influenced by the land tenure system. Legal restrictions placed on ejido holdings prevent the sale, rental, or placing of any liens against the ejido land. It is assumed then, that the ejidatario would farm his own land, or, if unable to do so, would leave it idle.

For the private property holder, on the other hand, there is a clear opportunity cost involved in leaving land idle. In contrast to the ejidatario, he does have the alternative of renting or selling such land rather than leaving it idle (assuming clear title exists).

Suppose, for example, the case of a private farmer with sufficient capital to farm all his land and with excess labor except during peak harvest periods. If expected farm income is inadequate in terms of his desires and alternative opportunities, one solution would be to rent additional land from a neighbor in a similar situation. Now the additional net income from the rented land would provide him with sufficient income to meet his reservation price. His neighbor could turn to other employment alternatives while receiving supplementary income from the rented land. Both parcels of land will be utilized for production. For a similar pair of ejidatario neighbors, the situation might be quite different. Their alternatives would be limited to three: (1) they could leave the land idle and seek employment elsewhere, eventually losing the rights to their land; (2) they could combine farm and off-farm work on a part time basis; (3) they could continue accepting an income level below that desired, rather than lose the rights to the land. Actually, in some instances a fourth alternative exists--rental or purchase of private property to supplement their ejido holdings. At any rate, based on the above argument, there appears to be greater possibility of land being left idle in the ejido[194], than in the private sector.

Hypothesis 2.2 may be inappropriate for the collective ejido. Here it would be possible for members to leave the ejido without bringing cultivation to a halt, since those remaining behind could take up the slack. However, the aggregation of collective with individual ejidos in the data is not viewed as a serious limitation in testing Hypothesis 2.2, since only about three percent of all ejido societies are of a collective nature. In the vast majority of the ejidos, assigned plots are cultivated individually.

A contrary but popular hypothesis holds idle land to be associated with larger latifundio land holdings. This "latifundio hypothesis" maintains that large holdings are often left idle rather than cultivated

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[194]The strength of the land tenure argument would be reduced if it were found that the legal provisions were disregarded and that rental of ejido lands were a frequent occurrence. Such reports are not infrequent. Silos found ejidatarios often rented their land to the more highly capitalized private owners (Silos. op. cit.), as did Ladman in Apatzingán (Ladman. op. cit. pp. 90-95), a finding supported by the present study. Mention of this practice is also made in T. de la Peña, Moisés. op. cit. pp. 375-377 and in Fernández y Fernández, Ramón. El problema agrario actual. Boletin de Estudios Especiales. Banco Nacional de Crédito Ejidal. Vol. 15, no. 175, pp. 217-221, August, 1959, pp. 219-220. Even so, it is hard to imagine that more renting would occur in the ejido than in the private sector.

because they are held for prestige and as a hedge against inflation. However, according to the census definition, this land would have to be cultivated at least once every five years. Hypothesis 2.2 is advanced in lieu of the latifundio hypothesis since it is assumed such holdings would rarely be developed for cultivation. Although severe land underutilization problems could be expected, this would not appear as idle land in the census unless errors were made in interpretation of the idle land definition. Unfortunately, there is no way to test the latifundio hypothesis since census data combines all holdings over five hectares into a single category.

Because formation of an ejido society depends on governmental decree, the relative concentration of ejido and private holdings in any region would be outside the control of the individual firm.

Hypothesis 2.3: Areas of greater off-farm employment alternatives are characterized by larger amounts of idle land:

Hypothesis 2.3 assumes that greater alternative employment possibilities will induce more peasants to leave agriculture, and in the process leave part or all of their land idle.

To a certain degree, the employment variable can be considered controllable by the individual. Certainly off-farm employment possibilities depend on education and training which he can control to some degree. However, employment alternatives for unskilled laborers (the usual case assumed for rural workers) may be more dependent on the level of economic development in the immediate area. Encouragement of such development would be within the purview of government, controllable by tax concessions, provision of services, etc. according to industrial decentralization policies followed. Location of training centers for unskilled workers would also depend on governmental policies.

d. Largely uncontrollable variables

Hypothesis 3.1: Long-run weather characteristics are not significant in explaining idle land:

Casual examination of state by state variation (see Table 3.2) suggests idle land differences are not associated with regional, or long run weather characteristics. However, due to the widespread belief that such weather (or regional) factors are the prime consideration in the incidence of idle land, further tests on the possibility of the effect of long run weather were desired. It is tentatively hypothesized that the commonly held belief is incorrect which asserts higher incidence of idle land in wet-tropical, and/or more arid areas.

Hypothesis 3.2: Greater amounts of idle land will occur in areas of unseasonable weather:

It is supposed that inclement weather before planting could force the farmer to leave part of his land idle, especially if such conditions extended beyond the usual acceptable planting period. Unseasonable weather might cause additional operations, or delay operations so that a timetable could not be met which would allow planting all the land. This hypothesis would seem especially true for crops which are more sensitive to climatic conditions.

Hypothesis 3.3: Greater amounts of idle land will be encountered when land holdings are of poorer quality:

Hypothesis 3.3 is based on the relative marginal productivities of land holdings. For example, it is assumed that areas of more easily erodable hillside land would be left idle before similar flat lands; that cultivated rocky soil would be left idle before loam soils, etc. Resources are expected to be applied first to better quality land.

Although land quality can be controlled to some extent by the individual, limits of control are viewed as greatly restricted by natural conditions.

Hypothesis 3.4: Systematic biases in census reporting can be detected which explain idle land levels reported:

Due to the difficulty with which an idle land definition is compiled, it is supposed that biases overstating the amount of idle land will be found. In particular, land which should not be considered as cultivable (not having met the criterion of actual cultivation within the last five years) might at times be classified as cultivable solely on the basis of its potential. Possibilities of counteracting biases which would disregard idle land seem to be more remote.

Tests of Hypothesis 3.4 are important in meeting the sixth objective listed in Chapter I. To the extent that systematic and serious errors are encountered in census reporting, care must be taken in future research in accepting this source of information before ascertaining the magnitude and type of bias introduced.

In Chapter V, an examination of the regression models and case study approach which is used for testing these diagnostic hypotheses is presented. The results of these tests are in Chapter VI.

# V. DEVELOPMENT OF THE MODELS USED TO TEST THE DIAGNOSTIC HYPOTHESES

The second and third objectives of this study are the identification and ranking by importance of those variables which best explain the idle land situation. Pursuit of these objectives requires selection of an appropriate model to be fitted to the data available.

## A. Multiple Regression Model

Sprent[195] has indicated that "any problem involving the expression of the mean value of a variate as a function of other variates or variables is certainly a regression problem". Snedecor and Cochran[196] indicate that a principal use of multiple regression is "...to discover which variables are related to Y, and, if possible, to rate the variables in order of their importance". Therefore, the multiple regression model is appropriate to the purposes of the present study.

Multiple regression also provides further tests of the extent to which idle land is important to the economic development of Mexico. If a reasonable model is devised which explains a large amount of the variation in idle land, the argument that "idle land" is a figment of census errors can be rejected. The significance of the total regression

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[195]Sprent, Peter. Models in regression and related topics. Methuen. London. 1969. p. 5.

[196]Snedecor, George W. and Cochrane, William G. Statistical methods. 6th ed. Iowa State Univ. Press, Ames, Iowa. 1967. p. 381.

equation, and its ability to explain total variation in the dependent variable, provide further indications of importance of idle land in addition to those of Chapter III.

Once the reasons for idle land are ascertained, the remaining objectives - of formulating policy alternatives to remedy the situation and of evaluating the need for further research - can be embarked upon.

The multiple regression model which is linear in the parameters can be expressed in matrix terms as follows[197]:

$$Y = X\beta + \varepsilon \tag{4.1}$$

Where: Y is an (n x 1) vector of observations of the dependent or response variable,

X is an (n x p) matrix of independent variables,

β is a (p x 1) vector of parameters including the intercept values and the regression coefficients or slopes,

and ε is an (n x 1) vector of errors,

and where the least squares assumption, $\varepsilon \sim N(0, I\sigma^2)$ is made which indicates the ε follow an n-dimensional multivariate normal distribution with $E(\varepsilon) = 0$, $V(\varepsilon) = I\sigma^2$, such that the elements are uncorrelated, and the F and t tests are then possible.

The error sum of squares if given by:

$$\varepsilon'\varepsilon = Y'Y - 2\beta X'Y + \beta'X'X\beta. \tag{4.2}$$

[197] Draper, N. R. and Smith, H. Applied regression analysis. John Wiley & Sons, Inc., New York. 1966. See especially pp. 44-85 and pp. 104-127.

The prediction equation for a given sample of n observations on the Y and X's is:

$$E(Y) = \hat{Y} = Xb. \tag{4.3}$$

In the present study, regression analysis is used to determine how changes in the independent variables affect, or determine the level of, the dependent or response variable. The least squares or maximum likelihood method provides meaningful conclusions about the dependency relationships which may exist. The extimates of the parameters $\beta' = (\beta_o, \beta_1, \ldots, \beta_p)$, given by $b' = (b_0, b_1, \ldots, b_p)$, are those values of b which minimize (4.2) and result in estimates which are unbiased (if the model is correct) and have the smallest standard errors of any unbiased estimates that are linear expressions in the Y's[198].

By differentiating the sum of squares or deviations from the true line with respect to the parameters and setting this equal to zero, the normal equations are found which can be written in the form:

$$(X'X)b = X'Y \tag{4.4}$$

Provided the p normal equations are indepenent, the X'X is non-singular and its inverse exists. It is then possible to solve the linear regression equation to derive the least squares estimate of the parameters, which is given by:

$$b = (X'X)^{-1}X'Y. \tag{4.5}$$

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[198] Snedecor and Cochrane. _op. cit._, p. 382.

The b values so obtained indicate the slope of the least squares regression line relating the independent and dependent variables. If this value is significant, as indicated by the t value, the two variables are considered to be significantly related.

Besides the b values, the significance of the total regression equation is of interest and is determined by the F values. Also of interest is the amount of total variation in the dependent variable which is explained by the independent variates, as indicated by the $R^2$ values. The specific statistical procedure utilized for selection of variables in the regression equation was the stepwise regression procedure[199].

The following are important assumptions made in the model described in (4.1):

1. the observations of X are assumed to be made free of error,
2. apart from the random fluctuations of the error term, Y is a linear function of the X's,
3. the random fluctuations are independent of the X's and have the same normal distribution regardless of the level of X.

The latter two assumptions are probably the least critical to the present study. In accepting the linear relationship, we assume that curvilinear effects are small compared to the random fluctuations for the range within which the $X_{ij}$ observations occur. Such an assumption

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[199]For a detailed discussion of this procedure, see: Draper and Smith. op. cit., pp. 171-195. The procedure utilized in the present study varied slightly from that described, in that the stepwise process was allowed to proceed until all hypothesized variables were included in the total regression equation.

does not appear unreasonable.

It is unlikely that the observations made in one area will influence observations made in another area, or that the size of the random errors would increase as levels of the X's increase. It is possible that levels of the X's in the t-1 census may influence the results of the census in period t; however, this would result in a violation of the first assumption not the third. In that regard, some question remains about the accuracy of the $X_{ij}$ and even the $Y_i$ sample values. Despite its shortcomings, however, the census probably provides the best data available. Thus, as a first step, the census was assumed to be correct, deferring until later an evaluation of the degree to which this assumption was violated.

Despite the appropriateness of multiple regression as a statistical method for identifying variables which explain idle land, a number of weaknesses inherent in this method and in its use in the present study must be recognized.

First, time series data are needed to isolate the effects over time of the relevant variables. However, scarcity of data, the 10 year time span between census compilation, and changes in census reporting procedures dictate the postponement of such a study. For the present, we shall be content to examine the following type of question: What effect does a higher or lower level of $X_j$ have on the amount of idle land encountered? Thus, the problem is one of comparative statics for which cross-sectional data is appropriate. Implicit in the use of cross section regression analysis is the assumption that observations in fact represent points of equilibrium. This may not be the case, especially where lengthy adjustment periods are involved--a situation likely to be encountered in the decision to leave land idle. Time series studies would ultimately provide a valuable supplement to this cross-sectional study. When published, the 1970 Mexican Agricultural Census may be valuable in this area, possibly allowing a more valid comparison of first differences for the 1960-70 period than is possible for the 1950-60 period.

The usual process of empirical model development involves guesses about why people act the way they do. "Expert opinion" is often utilized to arrive at these hypotheses. The statistical methods are then used to check the accuracy of these guesses. This approach is limited to testing those hypotheses which have been postulated, and although it can suggest incorrect guesses, it provides little information about which relevant variables have been omitted (except to the extent that examination of residuals may lead to more adequate guesses).

An additional limitation concerns data requirements of the multiple regression model. Unavailability of data results in the necessity of using proxy variables. Such "stand-ins" may deviate rather substantially from the desired measurement, lessening confidence in the results. For example, the desired measurement may be: "actual capital applied per hectare of cultivable land". The proxy variable used may have to be "total capital applied to all land as a ratio of total cultivable land". Such a "capital per cultivable hectare" measurement assumes capital applied to non-cultivable land is zero, or a constant proportion of that applied to cultivable land for all areas.

Even if the desired data were available, the model is limited to incorporation of quantifiable variables. Except through possible use of rather arbitrary dummy variables, it is difficult to incorporate such considerations as level of awareness of existing technology, importance of conformity to village traditions, desire for leisure time, etc. Even where construction of dummy variables might be possible, aggregation at county and state levels would be most difficult. From the policy point of view, however, alteration or manipulation of these variables may be as important and feasible as those of the regression model.

## B. Case Study Approach

To circumvent some of the limitations enumerated above, a case study approach utilizing survey data was selected to complement the regression results. In this way ascertainment of principal components in the decision-making process was attempted by direct questioning of the decision-makers. The case study is intended to increase knowledge of the subject, and offer clues for improving future investigation.

The survey approach also suffers from a number of limitations. Among these are the possible inability of respondents to articulate the true decision-making process; weighting problems; representativeness of the cases selected; wording of questions to provide unambiguous answers, etc. In addition, a number of categories contain only a small number of observations.

However, when used in conjunction with the statistical model, the case studies are felt to contribute valuable new insights. Such supplementary information is critical in an area of study such as idle land where: (1) the problem has been previously unrecognized or disregarded; (2) "expert opinion" appears contradictory as to the hypotheses to be tested. The case studies suggest additional variables and directions for further study, and offer policy alternatives to those of the regression model. Finally, considerable confidence is placed in this information, which thus provides a valuable check on census accuracy (objective six of Chapter I).

# VI. ANALYSIS OF RESULTS FROM APPLICATION OF THE MODELS TO THE DATA

Fulfillment of objectives two, three and six (stated in Chapter I) is undertaken in the present chapter. That is, reasons for idle land are identified, the relative importance of these reasons is assessed, and the reliability of Mexican Agricultural Census data is evaluated. Chapters II and III have examined the extent to which idle land is a strategic problem within the agricultural sector (objective one of this study). However, objective one is further pursued in this chapter wherein the diagnostic hypotheses developed in Chapter IV are tested by applying to the data the models described in Chapter V.

To achieve the above objectives, each of the three sections of this chapter contains tests of the diagnostic hypotheses at a different level of analysis. In section A, multiple linear regression analysis is used to test models developed at the state level. In section B, multiple linear regression analysis is used to test models developed at the county (municipio) level. Section C includes case study information which, in general, does not lend itself to statistical analysis, but which is important to the testing of the hypotheses developed. Due to the wide differences found in land tenure characteristics in both of the case study areas, section C is organized so that each hypothesis is tested by comparing case study area results within each land tenure category.

In the first section of the present chapter, all diagnostic hypotheses developed in Chapter IV are tested except Hypotheses 1.4 and 1.5, for which census data is not available. In the second section, the same hypotheses are tested at the county level with the additional exclusion of Hypothesis 2.3 due to unavailability of data. In the third section, tests of all delimited hypotheses are conducted except for Hypotheses 3.1 and 3.2 due to lack of information on weather variables. The results of the three sections are then integrated into a single determination of the validity of the diagnostic hypotheses in Chapter VII.

### A. Utilization of Regression Results at the State Level in Testing the Diagnostic Hypotheses

1. Description of state level sample and variables included in the analysis.

The sample utilized for the state level models consists of 31 observations including all the states and territories of the Republic of Mexico. The Federal District which contains Mexico City is excluded from the sample due to its smallness and its atypical agricultural characteristics. Models which included the Federal District differed little in their results from the 31 observation sample (compare models II and IIa).

The following variables are included in the state level models. Derivation of the variables is discussed in Appendix II.

$X_1$ = Percentage of cultivable land (in *ejidos* and in private holdings of more than five hectares) which is left idle for reasons other than rotation.

$X_2$ = Total capital per cultivable hectare on private holdings of more than five hectares.

$X_3$ = Total capital per cultivable hectare on ejido holdings.

$X_4$ = Percentage of total cultivable land in private holdings of more than five hectares.

$X_5$ = Percentage of total cultivable land in ejido holdings.

$X_6$ = Percentage of total cultivable land on private holdings of more than five hectares which is actually irrigated.

$X_7$ = Percentage of total cultivable land in ejido holdings which is actually irrigated.

$X_8$ = The ratio of urban to rural minimum legal wages.

$X_9$ = Percentage of the total area of a state considered to be influenced by cities with a population of over 70,000.

$X_{10}$= A measure of aridity in 1959 relative to average aridity over a 20 year period.

$X_{11}$= $(X_{12})^2$, as a measure of the combined effects of extreme aridity and wet tropical conditions.

$X_{12}$= A measure of average aridity over a 20 year period.

$X_{13}$= A measure of labor utilized per cultivable hectare on private holdings of more than five hectares.

$X_{14}$= A measure of labor utilized per cultivable hectare on ejido holdings.

$X_{15}$= Percentage of total pasture located on hillsides rather than on the plain.

$X_{16}$= Percentage of total cultivable land in private holdings of more than five hectares on which fertilizer application is practiced.

$X_{17}$= Percentage of total cultivable land in _ejido_ holdings on which fertilizer application is practiced.

$X_{18}$= Percentage of cultivable land held in private holdings of more than five hectares which is susceptible to cultivation but has not yet been opened to cultivation.

$X_{19}$= Percentage of cultivable land in _ejido_ holdings which is susceptible to cultivation but has not yet been opened to cultivation.

2. Results and interpretation of state level regression analysis

Regression results for state level models are presented in Table 6.1. Correlation coefficients, standard errors, and the Students t values for the independent variables are presented along with the square of the multiple correlation coefficient, $R^2$, and tabular t values of significance at the .10, .05, and .01 levels. Due to the nature of the information used and measurement difficulties associated with many of the variables, the signs of the correlation coefficients are considered to be of greater interest than the magnitude of the correlation coefficients themselves. In all models, the calculated values of the F test for regression are greater than the tabulated F values at the one percent level of significance.

Models I, II, and IIa contain the results of previously conducted preliminary studies[200]. Model IIa differs from Model II only in its

[200] Winkelman and Hansen., _op. cit._

Table 6.1. State level regression results

| Model | | Constant term | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ |
|---|---|---|---|---|---|---|---|---|---|
| I | coefficient | 30.328 | -57.655 | .338 | | | | | |
| | std. error | | 11.890 | .119 | | | | | |
| | t | | -4.849 | 2.850 | | | | | |
| II | coefficient | 24.543 | 19.435 | -69.071 | .431 | | -.347 | .392 | 1.563 |
| | std. error | | 26.880 | 22.743 | .205 | | .331 | .381 | 22.061 |
| | t | | .723 | -3.037 | 2.100 | | -1.050 | 1.029 | .071 |
| IIa | coefficient | 25.269 | 16.423 | -68.269 | .420 | | -.329 | .405 | 1.384 |
| | std. error | | 19.540 | 21.662 | .190 | | .304 | .363 | 21.465 |
| | t | | .840 | -3.151 | 2.209 | | -1.083 | 1.117 | .064 |
| III | coefficient | 4016.727 | -.511 | .304 | | | | | |
| | std. error | | .117 | .114 | | | | | |
| | t | | -4.346 | 2.666 | | | | | |
| IV | coefficient | 62.336 | | -57.931 | | -.311 | | | |
| | std. error | | | 12.138 | | .129 | | | |
| | t | | | -4.773 | | -2.407 | | | |
| V | coefficient | 66.607 | 6.722 | -66.381 | | -.306 | -.297 | .510 | -3.081 |
| | std. error | | 19.041 | 22.061 | | .156 | .309 | .370 | 21.460 |
| | t | | .353 | -3.009 | | -1.962 | -.960 | 1.379 | -.144 |
| VI | coefficient | 2811.934 | | -.410 | .339 | | | | |
| | std. error | | | .122 | .096 | | | | |
| | t | | | -3.371 | 3.520 | | | | |
| VII | coefficient | 5890.783 | .018 | -.520 | .214 | | -.008 | .309 | -1.476 |
| | std. error | | .296 | .222 | .216 | | .346 | .472 | 2.376 |
| | t | | .061 | -2.344 | .991 | | -.023 | .655 | -.621 |

Table 6.1. (Continued)

| Model | | $X_9$ | $X_{10}$ | $X_{11}$ | $X_{12}$ | $X_{13}$ | $X_{14}$ | $X_{15}$ | $X_{16}$ | $X_{17}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| I | coefficient | | 17.641 | | | -115.441 | | | | |
| | std. error | | 7.675 | | | 26.976 | | | | |
| | t | | 2.299 | | | -4.279 | | | | |
| II | coefficient | 1.481 | 19.148 | .0001 | -.057 | -121.322 | -6.493 | | | |
| | std. error | 4.335 | 9.916 | .0002 | .081 | 42.108 | 16.045 | | | |
| | t | .342 | 1.931 | .538 | -.707 | -2.881 | -.405 | | | |
| IIa | coefficient | 1.102 | 19.040 | .0001 | -.055 | -120.270 | -5.126 | | | |
| | std. error | 3.611 | 9.639 | .0002 | .078 | 40.563 | 13.482 | | | |
| | t | .305 | 1.975 | .536 | -.706 | -2.965 | -.380 | | | |
| III | coefficient | | 17.074 | | | -.109 | | -.173 | | |
| | std. error | | 7.279 | | | .026 | | .087 | | |
| | t | | 2.345 | | | -4.224 | | -1.987 | | |
| IV | coefficient | | 18.753 | | | -130.530 | | | | |
| | std. error | | 7.827 | | | 25.673 | | | | |
| | t | | 2.396 | | | -5.084 | | | | |
| V | coefficient | -1.509 | 20.007 | .0001 | -.039 | -113.886 | -10.213 | | | |
| | std. error | 3.330 | 9.809 | .0002 | .079 | 41.252 | 13.464 | | | |
| | t | -.453 | 2.040 | .414 | -.489 | -2.761 | -.759 | | | |
| VI | coefficient | | 15.044 | | | -.101 | | | | -.344 |
| | std. error | | 6.526 | | | .022 | | | | .211 |
| | t | | 2.305 | | | -4.527 | | | | -1.633 |
| VII | coefficient | .200 | 15.721 | .007 | .001 | -.092 | .0004 | -.153 | -.248 | -.695 |
| | std. error | .629 | 9.268 | .013 | .061 | .042 | .002 | .123 | .560 | .530 |
| | t | .318 | 1.696 | .550 | .010 | -2.206 | .225 | -1.245 | -.443 | -1.313 |

Table 6.1. (Continued)

| | Model | $X_{18}$ | $X_{19}$ | $R^2$ | Degrees freedom | Tabular t values | |
|---|---|---|---|---|---|---|---|
| I | coefficient | | | .785 | 26 | $t_{.10}$ | 1.706 |
| | std. error | | | | | $t_{.05}$ | 2.056 |
| | t | | | | | $t_{.01}$ | 2.779 |
| II | coefficient | | | .810 | 18 | $t_{.10}$ | 1.734 |
| | std. error | | | | | $t_{.05}$ | 2.101 |
| | t | | | | | $t_{.01}$ | 2.878 |
| IIa | coefficient | | | .815 | 19 | $t_{.10}$ | 1.729 |
| | std. error | | | | | $t_{.05}$ | 2.093 |
| | t | | | | | $t_{.01}$ | 2.861 |
| III | coefficient | | | .815 | 25 | $t_{.10}$ | 1.708 |
| | std. error | | | | | $t_{.05}$ | 2.060 |
| | t | | | | | $t_{.01}$ | 2.787 |
| IV | coefficient | | | .774 | 26 | $t_{.10}$ | 1.706 |
| | std. error | | | | | $t_{.05}$ | 2.056 |
| | t | | | | | $t_{.01}$ | 2.779 |
| V | coefficient | | | .806 | 18 | $t_{.10}$ | 1.734 |
| | std. error | | | | | $t_{.05}$ | 2.101 |
| | t | | | | | $t_{.01}$ | 2.878 |
| VI | coefficient | | .062 | .869 | 24 | $t_{.10}$ | 1.711 |
| | std. error | | .016 | | | $t_{.05}$ | 2.064 |
| | t | | 3.879 | | | $t_{.01}$ | 2.797 |
| VII | coefficient | -.008 | .050 | .896 | 13 | $t_{.10}$ | 1.771 |
| | std. error | .121 | .027 | | | $t_{.05}$ | 2.160 |
| | t | -.067 | 1.881 | | | $t_{.01}$ | 3.012 |

utilization of 32 observations. All other models are based on 31 observations and exclude data from the Federal District. Models III, IV, V, VI and VII represent expanded studies of the earlier models I, II, and IIa.

The simple correlation coefficients are presented in Table 6.2 for model VII, the most "complete" model. In general, instances of relatively high simple correlations are easily explained, and little reason was found to suspect the validity of the regression results on the basis of multicolinearity. The diagnostic hypotheses are tested below in accordance with the classification scheme described in Chapter IV.

a. Variables directly controllable by the firm

Hypothesis 1.1: As the amount of capital per cultivable hectare increases, the amount of idle land will decrease:

In the multiple regression results, the capital variable coefficients are of different sign for each sector. The *ejido* capital correlation coefficient is negative and significantly different from zero at the one percent level in all models except model VII, where it is significant at the five percent level. On the other hand, the capital variable for private holdings is positive but not significantly different from zero. Hence, it would appear that increases in capital would decrease idle land for the *ejido* sector, but would not influence the occurrence of idle land in the private sector.

This result is predictable, considering average amounts of capital in the *ejido* and private sectors and previous credit studies. Since the

Table 6.2. State level simple correlation coefficients derived from model VII

| Variable: | $X_1$ | $X_2$ | $X_3$ | $X_4$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ | $X_{10}$ | $X_{11}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $X_1$ | 1.000 | | | | | | | | | |
| $X_2$ | -.468 | 1.000 | | | | | | | | |
| $X_3$ | -.417 | .763 | 1.000 | | | | | | | |
| $X_4$ | .583 | -.056 | .126 | 1.000 | | | | | | |
| $X_6$ | -.259 | .838 | .628 | .201 | 1.000 | | | | | |
| $X_7$ | -.251 | .827 | .701 | .179 | .880 | 1.000 | | | | |
| $X_8$ | -.281 | -.088 | -.102 | -.369 | -.179 | -.083 | 1.000 | | | |
| $X_9$ | -.590 | .262 | .146 | -.665 | .126 | .102 | .236 | 1.000 | | |
| $X_{10}$ | .384 | .050 | .188 | .432 | .086 | .099 | .059 | -.271 | 1.000 | |
| $X_{11}$ | -.044 | .456 | .460 | .304 | .642 | .534 | -.149 | .054 | .128 | 1.000 |
| $X_{12}$ | -.069 | .493 | .456 | .305 | .684 | .601 | -.148 | -.022 | .202 | .918 |
| $X_{13}$ | -.701 | .314 | .144 | -.448 | .095 | .117 | .515 | .545 | -.199 | -.161 |
| $X_{14}$ | -.440 | .258 | .168 | -.508 | -.034 | .053 | .175 | .588 | -.079 | -.203 |
| $X_{15}$ | -.491 | .349 | .239 | -.245 | .393 | .335 | -.085 | .364 | -.101 | .171 |
| $X_{16}$ | -.501 | .651 | .458 | -.259 | .520 | .451 | -.146 | .644 | -.047 | .433 |
| $X_{17}$ | -.431 | .619 | .511 | -.146 | .640 | .663 | -.180 | .451 | -.204 | .665 |
| $X_{18}$ | .184 | -.032 | .120 | .218 | -.089 | -.017 | .209 | -.475 | .284 | -.145 |
| $X_{19}$ | .427 | -.072 | -.121 | .054 | -.135 | .035 | -.180 | .071 | -.016 | -.091 |

Table 6.2. (Continued)

| Variable: | $X_{12}$ | $X_{13}$ | $X_{14}$ | $X_{15}$ | $X_{16}$ | $X_{17}$ | $X_{18}$ | $X_{19}$ |
|---|---|---|---|---|---|---|---|---|
| $X_{12}$ | 1.000 | | | | | | | |
| $X_{13}$ | -.124 | 1.000 | | | | | | |
| $X_{14}$ | -.206 | .424 | 1.000 | | | | | |
| $X_{15}$ | .260 | .259 | .190 | 1.000 | | | | |
| $X_{16}$ | .460 | .321 | .490 | .327 | 1.000 | | | |
| $X_{17}$ | .632 | .089 | .169 | .344 | .715 | 1.000 | | |
| $X_{18}$ | -.131 | -.108 | -.082 | -.316 | -.452 | -.406 | 1.000 | |
| $X_{19}$ | -.148 | -.211 | -.007 | -.285 | -.024 | .039 | -.169 | 1.000 |

*ejido* lacks the possibility of property mortgage as a loan security, special governmental banks are required to provide credit to this sector. However, since funds are severely limited, the proportion of *ejidatarios* who actually receive loans is quite small[201]. In addition, the amount loaned is often very limited[202], and those receiving credit tend to be better-off *ejidatarios* who possess irrigated lands[203].

A further limitation to availability of *ejido* credit results from legal provisions which encourage loaning to *ejido* credit societies rather than directly to individuals[204]. Besides problems inherent in formation of such groups, all members are held accountable for the default of payment by any other member. Therefore, creditworthy *ejidatarios* may be discouraged from entering into such agreements.

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[201] The figure most frequently cited suggests only 10-15 percent of the *ejidatarios* receive loans from the *Ejido* Bank. See: Zepeda Salazar, Primitivo G. Algunos aspectos del problema agrario mexicano actual. In Crédito Agrícola. Fernández y Fernández, Ramón, ed. Vol. VIII. Centro de Economía Agrícola. Escuela Nacional de Agricultura. Chapingo, México. 1967. (pages unnumbered); Durán, Marco Antonio. La Reforma., *op. cit.*, p. 498, and Freebairn, *op. cit.*, p. 36.

[202] In 1965, 692,000,000 pesos were reportedly loaned by the *Ejido* Bank. (See Fernández y Fernández, Ramón. El agrarismo mexicano. In Fernández y Fernández, Ramón., ed. Crédito Agrícola. Vol. VII. Centro de Economía Agrícola. Escuela Nacional de Agricultura. Chapingo, México. 1967. (pages unnumbered.) If it is assumed the number of *ejidatarios* had increased from the 1.6 million reported in the 1960 Mexican Agricultural Census to 2.2 million by 1965 (Edmundo Flores estimates 2.4 million *ejidatarios* in 1967. See: Flores, Edmundo. Cómo funciona el sector agropecuario. *op. cit.*, p. 710.), then the average loan made by the Bank that year was between $2,000 and $3,150 pesos ($160.00 to $250.00 U.S.).

[203] Lewis. *op. cit.*, pp. 318-319.

[204] Leyes. Código agrario. *op. cit.*, Ley de crédito agrícola. Art. 118. pp. 364-365.

Following the reasoning developed in Chapter IV, it is possible that capital is so limited in the ejido sector that increasing marginal returns are still experienced, whereas, in the private sector, sufficient capital is available so diminishing marginal returns are encountered. If this were true, it would be rational for the ejidatario to apply capital to only part of his land, leaving the rest idle, whereas the private farmer would utilize all of his cultivable land.

Higher capital per cultivable hectare in the private sector may be attributed not only to greater credit accessibility and increased savings, but also to the way in which land redistribution is carried out. When land is expropriated, the original private owner is permitted to select that portion of his holdings which he wishes to retain (within the allowable size)[205]. Thus, the retained portion usually contains large amounts of fixed capital in the form of buildings, irrigation installations, etc.

Although the regression results in this section do not support the thesis that credit availability problems exist for the smaller private farmer, it is possible that the census data utilized is heavily weighted by larger private farms and the presence of certain types of fixed capital. Therefore, the role of capital in the private sector may be more important in explaining idle land than results of this section indicate[206].

Limitations to the appropriateness of the capital measurement are many. In addition to aggregation problems indicated above, any information

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[205] See Leyes. Código agrario. op. cit., Art. 105. p. 42.

[206] See p. 168 and pp. 194 - 195 for substantiation of this point.

of a monetary nature solicited through direct questions (as done in the census) should be viewed with suspicion. It is doubtful that the farmers are willing to discuss such confidential information freely with governmental census enumerators.

As a further limitation, the measurement is derived from total capital divided by total cultivable hectares. To the extent capital is used in livestock operations or on non-cultivated lands, a bias may be introduced when capital is considered as being utilized only on cultivable land.

Based on the results obtained and the limitations of the capital measurement utilized, further studies were desired at disaggregated levels where more specific capital measurements could be used. Results of this extended study are presented in section B. However, tentative support is herein found for Hypothesis 1.1 for the *ejido* sector.

*Hypothesis 1.2: As the amount of labor utilized per hectare of cultivable land is increased, the amount of idle land will decrease:*

The labor variables for private holdings of more than five hectares were negative and significant at the one percent level in all models except models V and VII, where they were significant at the five percent level. For the *ejido* sector the labor variables were generally negative but not significantly different from zero in any model. In interpreting these results, the opposite situation is suggested to that of the capital variables. Increases in labor utilized would decrease idle land in the private sector, but would not influence idle land in the *ejido* sector.

The result is again predictable on the basis of average labor utilized by the two sectors. The average amount of labor utilized per cultivable hectare in the _ejido_ is nearly twice that reported for the private sector.

The reasoning advanced to explain the capital variable results is also applicable to the labor variables. It is possible that labor use in the private sector was so limited that increasing returns to labor were still experienced, whereas in the _ejido_ sector greater utilization resulted in diminishing returns to labor. If such were the situation, it would be rational for the profit-maximizing private farmer to utilize the labor resources on only part of his land, leaving the rest idle, whereas the _ejidatario_ would utilize all of his cultivable land.

Although the increasing returns argument appears to be less plausible for the labor situation, there are instances where increasing returns could be encountered. Often large private holdings are located in such remote areas that labor resources are hard to secure. For those farmers, labor required during peak seasons might be especially difficult to count on. By contrast, _ejido_ holdings tend to be small and associated with a population center. Even so, it is doubtful that the private farmer would be unable to pay wages necessary to secure labor requirements in the usual case. It is more plausible that in certain instances he would purposely limit the amount of labor employed. For larger holdings, increased labor use might also increase susceptibility to "_paracaidista_" and other land dispute problems discussed in Chapter II[207]. Such self imposed labor restrictions could result in intensive cultivation of a small part of the holding by substitution of capital for labor, with the intensively cultivated portion rotated and then left idle. Alternatively, all the holding could be farmed extensively, for example leaving it in natural pasture for cattle. The first alternative would result in idle land as hypothesized (Hypothesis 1.2). However, in the second case, the regression result noted would arise only if this land had been incorrectly classified as idle rather than correctly as "susceptible to cultivation".

Limitations of the labor variable utilized are many. The labor per cultivable hectare measurement was derived from total labor utilized divided by total cultivable land. As with the capital variable, to the extent labor is used in non-cultivation activities, a bias may be introduced in assuming that all workers apply their services to cultivable land.

More seriously, the labor measurement indicates total number of people working on the holdings rather than man-days employed. Those working on a permanent basis are attributed the same weight as those working only seasonally. In addition, female and child labor (under 15 years), which in some instances may be important labor sources, have been excluded. These objections can be lessened to a certain extent by disaggregation as to type of labor employed, but even then only a very gross labor estimate results. Disaggregation as to type of labor

[207]See pp. 25-27.

employed is undertaken in the county level section. For the present, support of Hypothesis 1.2 is found for the private sector.

Hypothesis 1.3: As the level of technology adopted increases, the amount of idle land will decrease:

The number of cultivable hectares to which fertilizer was applied is used as a proxy variable for adoption of new technology. It is assumed that a farmer who is willing to undertake the risk involved in utilization of fertilizers would also be more favorably disposed towards adoption of other new inputs such as insecticides, hybrids, improved seed, herbicides, etc.

The fertilizer coefficient signs are negative as hypothesized for both the *ejido* and private holdings. However, only for the *ejido* sector are the t values large enough to consider the results possibly significant from zero, approaching the 10 per cent level of significance in model VI. The results suggest that fertilizer utilization (or technology adoption) may be a factor limiting land utilization in the *ejido* sector, but not in the private sector. This is also indicated by the averages which show that the percent of cultivable hectares fertilized is approximately one third greater in the private sector. The possible differences in adoption of new practices suggested by these results are consistent with other findings indicating the *ejidatario* is less willing (or less able) to adopt new practices than the private farmer[208].

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[208] A number of studies indicating lower adoption rates of new practices are reviewed in Fernández y Fernández, Ramón. Contribuciones del ejido y la pequeña propiedad (footnote continued on following page)

The fertilizer measurement divides total hectares fertilized by total cultivable hectares to arrive at the percentage of fertilized cultivable hectares. Use of the input on non-cultivated land would be the decided exception.

A more serious limitation of the measurement is that it considers only the total number of hectares to which fertilizer was applied. The amount and type of fertilizer used is not considered. Amount applied per hectare is probably a less important limitation to a proxy variable for adoption of technology that if a measure of fertilizer response *per se* were intended. However, failure to specify type of fertilizer is a serious limitation. Both animal manure and commercial fertilizers are included. Utilization of animal manure would be a much poorer indication of adoption of new technology than commercial fertilizer use.

Finally, fertilizer use is but one small facet of technology adoption. Complications arise from the fact that fertilizer use was closely correlated with irrigation (simple correlation coefficients of .52 for $X_6$,$X_{16}$ and .66 for $X_7$,$X_{17}$). Other measures, particularly those related to crops grown under seasonal weather conditions, might better indicate the relation between idle land and the propensity to adopt new technology.

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(footnote continued from preceding page) al desarrollo agrícola. Centro de Economía Agrícola. Escuela Nacional de Agricultura. Chapingo, México. 1968. pp. 96-98. Further support is found in: Silos. Instituciones. *op. cit.*, and in Burguete Hernández, Carlos E. Los nuevos patrones. In Fernández y Fernández, Ramón, ed. Crédito Agrícola. Vol VIII. Centro de Economía Agrícola. Escuela Nacional de Agricultura. Chapingo, México. 1967. (pages unnumbered).

Thus, at best only weak support is found in the ejido sector for Hypothesis 1.3.

b. Variables outside the direct control of the firm

Hypothesis 2.1: Areas of greater irrigation development will tend to have less idle land:

The multiple regression results reveal irrigation variable coefficients of a negative sign as hypothesized for private holdings, but positive for ejido holdings. In no case were the coefficients significantly different from zero at the 10 percent level, yet the t values in models II, IIa, and V are sufficiently high to warrant discussion.

A possible explanation for the positive irrigation coefficient for ejido holdings could be encountered where part of the irrigable land is not actually irrigated due to scarcity of water. Since such land is considered irrigable, it might also be considered cultivable--especially if the portion actually irrigated is rotated within the holding. Failure to cultivate this land could then be considered proof of idleness, despite the idle land definition which implies that sufficient water should be available for land to be classified as irrigable[208a].

If incorrectly classified, irrigable (and hence cultivable) land might increase more rapidly than land actually irrigated. Since all the cultivable but unirrigated land would be considered idle, a positive correlation could be expected between idle land and actually irrigated land. The weakness of such an argument lies in the failure to explain

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[208a] See p. 5.

why this should be true for the ejido holdings, but not the private holdings[209]. Hence, results of Hypothesis 2.1 were inconclusive at the state level.

Hypothesis 2.2: Areas of heavier ejido concentration will tend to have higher amounts of idle land:

In all models, the land tenure coefficients, that is, the relation between idle land and the proportion of a state's cultivable area held in private holdings of over five hectares, had a positive sign rather than the hypothesized negative sign. Only in models V and VII were the t values not significantly different from zero at the five percent level. Land tenure findings indicate that as the percent of land in private farms of over five hectares increases, the rate of idle land increases[210].

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[209] Such an argument can be devised, however. Land classified as irrigable but not actually irrigated would tend to be found in scarce water areas serviced by large scale governmental projects. In the case of owner-developed irrigation facilities, actually irrigated land would tend to equal irrigable land. Since irrigation capital per cultivable hectare in the private holdings is more than five times that of the ejido sector (based on the county sample data), the private farms would be more likely to have irrigable land equal to actually irrigated land, and thus the negative coefficient as hypothesized. For the ejido sector, greater disparity between actually irrigated and irrigable (but not irrigated) land could result in the positive irrigation coefficient.

[210] As a check of the tenure variable, model IV is identical to model I except that the proportion of cultivable area in ejido holdings is used for the land tenure variable in place of private holdings over five hectares. A comparison of results of model IV and I indicates that either measure of land tenure is equally acceptable, and that exclusion of private holdings of less than five hectares does not influence the results obtained.

The findings lend support to the latifundio hypothesis[211] as an explanation of idle land, rather than to the hypothesized argument based on institutional restraints imposed by the ejido system. However, the regression result would then imply an error in census classification--with land classified as idle which could be opened to cultivation but which had never been cultivated. It is difficult to visualize latifundios with areas of intensive cultivation being successively rotated and left idle. This is especially true when such a practice would greatly reduce the amount of land exempt from expropriation compared to allowable-sized holdings of natural pasture[211a].

Examination of the simple correlation coefficients for the land tenure variable also reveals support of the latifundio hypothesis. The negative simple correlation coefficient between the tenure variable and labor utilized in private holdings over five hectares ($X_4$,$X_{13}$); the low amount of average labor reported per hectare for the private sector; the simple correlations between the tenure variable and capital per cultivable hectare ($X_4$,$X_2$ < 0), percentage of cultivable land receiving fertilizer application ($X_4$,$X_{16}$ < 0), and the land susceptible to cultivation but not yet opened to cultivation ($X_4$,$X_{18}$ > 0), all indicate that as

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[211] The latifundio hypothesis maintains that large holdings are neither farmed intensively nor rented out, but rather held as a hedge against inflation or the prestige. Such holdings would be farmed extensively, if at all.

[211a] See, for example: Leyes. Código Agrario. op. cit., Reglamento de inafectabilidad agrícola y ganadera. Art. 7. p. 216.

the proportion of a state held in private holdings over five hectares increases, more extensive agricultural practices are followed. The one variable whose simple correlation coefficient is of opposite sign to the *latifundio* hypothesis is the irrigation variable ($X_4, X_6 > 0$).

Although it is not meant to be implied that all farms over five hectares are *latifundios*, this category should contain all *latifundios*. It is not possible to further refine the census data for size of holdings.

The *latifundio* hypothesis becomes more difficult to disregard when the land tenure variable is interpreted as the percent of cultivable area in *ejido* holdings ($-X_4$), and the simple correlation coefficients are of opposite sign for all variables considered above, with the exception of the capital variable which is also negative for the *ejido* sector ($X_4, X_3 < 0$). However, the latter is regarded as a sign of capital shortage rather than intentional extensive use of land. The simple correlation coefficients again indicate more intensive cultivation as the proportion of *ejido* holdings increases.

Considerable support was found for rejecting Hypothesis 2.2 and accepting the *latifundio* hypothesis in its stead. A primary motivation for continued idle land study at the county and local level was the desire to explore Hypothesis 2.2 further.

*Hypothesis 2.3: Areas of greater off-farm employment alternatives are characterized by larger amounts of idle land:*

Two variables are utilized to determine off-farm employment opportunities. The first variable consists of the ratio of minimum wages for urban areas compared to those of rural areas. The greater this ratio for any state, the more off-farm employment opportunities assumed which might induce farmers to leave their land idle.

The second measurement assumes that cities have a circular area of influence proportional to their population. The wider the area of city influence, the greater the alternative employment opportunities which exert pressure to leave the farm, with the possible resulting consequence that land is left idle.

The multiple regression results for models II, IV, and VII show great instability of sign and very low t values for both measurements. It would appear that off-farm alternatives, as measured by these variables, are not important in explaining idle land.

It is possible that the low t values stem from long-run considerations. That is, the minimum wage differential tends to remain at the same level over time. The percentage of a state lying within the area of influence of large cities would also tend to remain constant over time. No measure was found for short-run changes in employment opportunities, which would more likely influence idle land than long-run adjustments.

City size as an indication of off-farm employment opportunities may be suspect. Size alone may not indicate presence of employment alternatives. Some measurement of unemployment in the cities would be desirable. Also, the relation assumed between size of city and the size of the supposed area of influence is arbitrary.

The minimum wage differential may also be unsatisfactory as an indication of urban employment opportunities. Actual wage differentials, especially for the class with limited skills into which those leaving their farms would tend to fall, would be more indicative of the opportunities available than simply the legal minimum wage.

c. Largely uncontrollable variables

Hypothesis 3.1: Long-run weather characteristics are not significant in explaining idle land:

To measure the effect of weather on idle land, an aridity index developed by the University of Mexico was utilized[212]. For the most part, the aridity measurements are based on 20-year averages for reporting weather stations, although in some cases the number of observations was less. Stations for which the aridity index information was available were combined to give a measure of "average weather" for the state. The aridity index weather variable was also employed in its squared form to test the combined effect of wet tropical and desert conditions.

The signs of the aridity index and its square were as expected in models II and IV: positive for average weather, indicating greater idle land as aridity increases; negative for average weather squared, indicating greater idle land as both aridity and wet tropical conditions become more extreme. The only exception to the expected relation occurred in model VII, where the average weather squared coefficient was positive. However, in all instances the t values were so low that long-run weather

[212] An explanation of the index used is found in Soto Mora, Consuelo and Jáuregui O., Ernesto. Isotermas extremas y índice de aridéz en la República Mexicana. Universidad Nacional Autónoma de México. Instituto de Geografía. México. 1965. pp. 26-28.

could not be considered significantly different from zero. The findings thus support the hypothesis based on earlier casual observations: long-run regional weather conditions do not explain well the amount of idle land encountered.

The concept of "statewide average weather" may be of questionable validity--especially in very large states where topography and climate vary greatly. Averaging conditions at several weather stations also may not give a representative indication of weather conditions of that state. These limitations are largely overcome by utilizing county level weather information, which is much more likely to be representative of the region in which the idle land is being measured. Also, further tests at the county level were desired because of widespread disagreement between Hypothesis 3.1 and the commonly held belief that long-run weather is the most important explanatory variable.

Hypothesis 3.2: Greater amounts of idle land will occur in areas of unseasonable weather;

In all models tested, the sign of the relative weather coefficient was positive as hypothesized. That is, the drier the weather prior to planting, the more idle land found. The t values were high enough in all models (significant at 10 percent levels for all except model VII) to suggest that unseasonable dry weather influenced the idle land decision.

As with the "average weather" measurement, the validity of statewide "relative weather" may be questioned, as may be the reporting accuracy of some weather stations. Such inaccuracies would influence the numerator of the relative weather variable much more than the denominator, and thus make the relative weather measurement less reliable than that of average weather. Since average weather is utilized in the denominator, its limitations discussed under Hypothesis 3.1 also apply to the relative weather measurement. Again, objections to this measurement are partly overcome by the county level study.

Hypothesis 3.3: Greater amounts of idle land will be encountered when land holdings are of poorer quality:

To test the land-quality hypothesis, land which is "susceptible to cultivation but as yet unopened to cultivation" is used as a proxy variable for land quality. It is assumed that better quality lands would receive first priority in investment expenditures required for cultivation. However, areas of high amounts of land susceptible to cultivation are assumed also to have high amounts of cultivated land bordering the unopened land which is of lower quality. Thus, high proportions of land susceptible to cultivatión would be associated with bordering cultivated land or poorer quality, which would frequently be left idle.

The positive correlation coefficient and high t values for the land quality variable in the *ejido* sector suggest that land quality is important in determining whether *ejido* land will be left idle. However, for the private sector, the coefficient is negative and not significantly different from zero. The difference between the two sectors could be explained in the following way: as hypothesized, the *ejido* sector is apparently exploiting available land resources so heavily that any left "susceptible to cultivation" would be of truly inferior quality. In fact, poor quality land already in the cultivated base is being left idle at times. The private sector, on the other hand, may intentionally refrain from opening good quality land to cultivation for fear of exposure to expropriation. Such private sector lands "susceptible to cultivation" would not be as indicative of land of marginal quality as this measure is for the ejido sector.

It is acknowledged that the measure utilized is at best only an indication of land quality. Yet, the results obtained encourage further consideration of this hypothesis with more accurate land-quality measurements at the local level.

Hypothesis 3.4: Systematic biases in census reporting can be detected which explain idle land levels reported:

There is another way in which the disparity between the ejido and private sectors could arise. The manner in which census information is collected could result in biases. Information for the ejido sector is collected by each ejido president. By contrast, private sector information is compiled by enumerators hired by the census bureau. It is possible that, due to inaccessibility of many private holdings (or other obvious reasons), a certain amount of "censusing" is actually done in the "hotel room" of the enumerator. The ejido president, on the other hand, has ready access to the members of his ejido, and is already quite familiar with conditions in the ejido[213].

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[213] Support for such suspicions is given by Barkin, who cites census information as being quite reliable for the ejido, but much less so for private holdings. See Barkin. op. cit., pp. 37-38.

With regard to the idle land problem, an unreliable enumerator, observing that land in an area is capable of being cultivated might "determine" that many holdings on his list were idle, even though such lands may never have been opened to cultivation, and may have been used for natural pasture, if at all. Notice that his land should be classified as "susceptible to cultivation" and not idle, rather than cultivable but idle. Such an incorrect classification would tend to result in correlation coefficients of opposite sign for the private sector than postulated in Hypothesis 2.2 and 3.3--a tendency noted in those sections.

With strong population pressures, small plot size, and sanctions against idle land in the ejido sector, a high degree of land cultivation is expected. However, for the large private holdings, strong incentives exist which encourage leaving land in natural pasture to avoid expropriation. Much higher amounts of land susceptible to cultivation (as a percentage of presently cultivable land) would thus be expected to be found in the private sector. Indeed, the national averages of 18 percent and 31 percent respectively for the ejido and private sectors do not support the suspicion that private sector lands susceptible to cultivation were misclassified. However, an examination of the data at the state level most certainly does arouse strong suspicions (see Table 6.3).

As seen in Table 6.3, the data for Quintana Roo, Morelos, Michoacan, Guerrero, Campeche, and to a lesser extent Baja California and Baja California Sur, all suggest misclassification in the private sector if it is assumed that much higher amounts of land susceptible to cultivation

Table 6.3. Amount of land susceptible to cultivation as a percentage of total cultivable area, by state and by sector, 1960[a]

| State (by region) | *Ejido* sector | Private sector (holdings over five hectares) |
|---|---|---|
| North | | |
| Coahuila | 6.60 | 41.73 |
| Chihuahua | 27.23 | 37.53 |
| Durango | 6.75 | 8.59 |
| Nuevo Leon | 14.00 | 25.42 |
| San Luis Potosi | 12.92 | 38.61 |
| Tamaulipas | 30.94 | 65.36 |
| Zacatecas | 4.06 | 19.87 |
| Gulf | | |
| Campeche | 39.87 | 12.23 |
| Quintana Roo | 374.31 | 12.41 |
| Tabasco | 14.14 | 27.40 |
| Veracruz | 12.86 | 38.28 |
| Yucatan | 7.34 | 55.44 |
| Northern Pacific | | |
| Baja California | 6.96 | 4.89 |
| Baja California, Sur | 22.31 | 22.56 |
| Nayarit | 12.83 | 29.86 |
| Sinoloa | 3.79 | 25.70 |
| Sonora | 21.52 | 27.09 |
| Southern Pacific | | |
| Colima | 1.07 | 17.91 |
| Chiapas | 16.11 | 61.02 |
| Guerrero | 13.26 | 4.59 |
| Oaxaca | 18.86 | 75.69 |
| Central | | |
| Aguascalientes | 5.97 | 13.52 |
| Guanajuato | 1.61 | 5.24 |
| Hidalgo | 7.99 | 54.99 |
| Jalisco | 4.58 | 14.00 |
| Mexico | 5.44 | 6.04 |
| Michoacan | 36.06 | 6.11 |
| Morelos | 336.07 | 7.59 |
| Puebla | 3.90 | 12.87 |
| Queretaro | 3.50 | 6.11 |
| Tlaxcala | 3.79 | 3.18 |

[a]Source: Calculated from information contained in Secretaría de Industria y Comercio. Dirección General de Estadística. Cuarto censos agrícola-ganadero y ejidal. *op. cit.*

should be found in the private than in the ejido sector as argued above. A number of states show lesser indications of the same possible misclassification of private land as cultivable but idle rather than susceptible to cultivation. These include: Durango, Sonora, Mexico, Queretaro, and Tlaxcala. In fact, the average of the state percentages of land susceptible to cultivation is higher for the ejido than for the private sector (35 and 24 percent respectively).

Another method devised to measure possible systematic census bias was to use percentage of total pasture located on hillsides rather than on the plains. This measure was considered as a proxy for steepness of topography. If idle land were positively related to steepness, this could indicate its use as a means to achieve soil conservation. If, on the other hand, idle land and steepness of topography were negatively related, the census enumerator was quite possibly confusing flatland pastures with cultivable lands and misclassifying such pastures as cultivable but idle. The t values in model III (and to a lesser degree in model VII) for the steepness coefficient are of negative sign and sufficiently high (significant at the 10 percent level) to again suggest the possibility that "idle lands" are in part the result of census classification errors.

The arbitrariness of the topography measure is apparent. Interpretation of the coefficient signs is also felt to be more tenuous than that of the other variables considered in the models of this section.

In view of the promising results at the state level, it was hoped that some of the questions raised could be answered at the county level, wherein more degrees of freedom, greater disaggregation of the variables, and increased accuracy of the measurement for the area of analysis could be achieved. In Section B, which follows, the criteria for selecting the sample, the location of the counties, and the variable included in the analysis are described, followed by an analysis of the county level multiple regression results. Reconciliation of these results with those of the state level is deferred until Chapter VII.

### B. Utilization of Regression Results at the County Level in Testing the Diagnostic Hypotheses

In this section the diagnostic hypotheses developed in Chapter IV are tested at the county level to clarify and extend the results found at the state level. Study at the county level has the advantage of providing more appropriate weather information than the average measure utilized for entire states. In addition, disaggregation of the capital and labor variables was possible rather than dependence on the single aggregate measurements used at the state level.

#### 1. Description of county level sample and variables included in the analysis.

The criteria used for selecting the sample granted equal weight to total land area and to total value of agricultural production for each state. To accomplish this, the number of county observations included for any state equaled the sum of the states' area as a percent of the country's area plus the states' value of agricultural product as a percent of the country's value of agricultural product[214].

After excluding the Federal District and rounding to whole numbers, the goal of a sample size of 198 observations was set. There was sufficient information to complete 184 of the desired 198 observations. The states for which observations could not be included due to lack of weather data were: Coahuila (1), Chihuahua (5), Durango (6), Guerrero (1), and Sinaloa (1). Such a sample would have had some under-representation of the northern states. In order to overcome this deficiency, the 14 observations were completed by selecting counties which were adjacent to those containing one or more weather stations. In such cases, the weather station information was considered also to pertain to those counties added to complete the sample.

It was also decided that each county should meet a minimum size requirement. This was needed because of extremely large variation in county size. Failure to make such an adjustment would have meant that very small counties with little agricultural production would have had the same weight in the sample as very large and important counties. The minimum area established was 40,000 hectares total land area, or 10,000 hectares of cultivable land area.

There were 26 observations which did not meet these minimum area requirements. In these instances, adjoining counties as close as possible to the location of the weather station were combined with the original

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[214] As an example, for the state of Guanajuato, with 1.56 percent of total land area and 3.47 percent of total agricultural production, five county observations were included in the sample.

county until the minimum area requirement was fulfilled. Thus, for 26 observations, the "county" is actually a combination of two or more counties.

Late in the study, analysis of data revealed such contradictory information for one county in Durango as to cause it to be discarded, leaving a sample size of 197.

The sample is not random since a restriction imposed required that weather information for a long period be available. Many counties are without such reporting services. However, for most states, choice was possible among different counties to allow selection of what appeared to be a geographically representative sample for the cultivable area of the state. The location of the weather stations themselves did not appear to introduce any appreciable bias into the sample. A possible exception is the tendency to have a disproportionate number of stations located at dam sites and in larger cities.

Although not a random sample, the goal of randomization is felt to have been fulfilled in the selection of a sample representative of Mexico. A map of the approximate location and size of the counties included in the sample is presented in Figure 6.1.

The following are the variables utilized in the county level models[215]:

$X_1$ = Percentage of cultivable land, in _ejido_ and private holdings of more than five hectares, which is left idle.

$X_2$ = Percentage of cultivable land in _ejido_ holdings which is left idle.

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[215] For a description of the detailed derivation, see Appendix II.

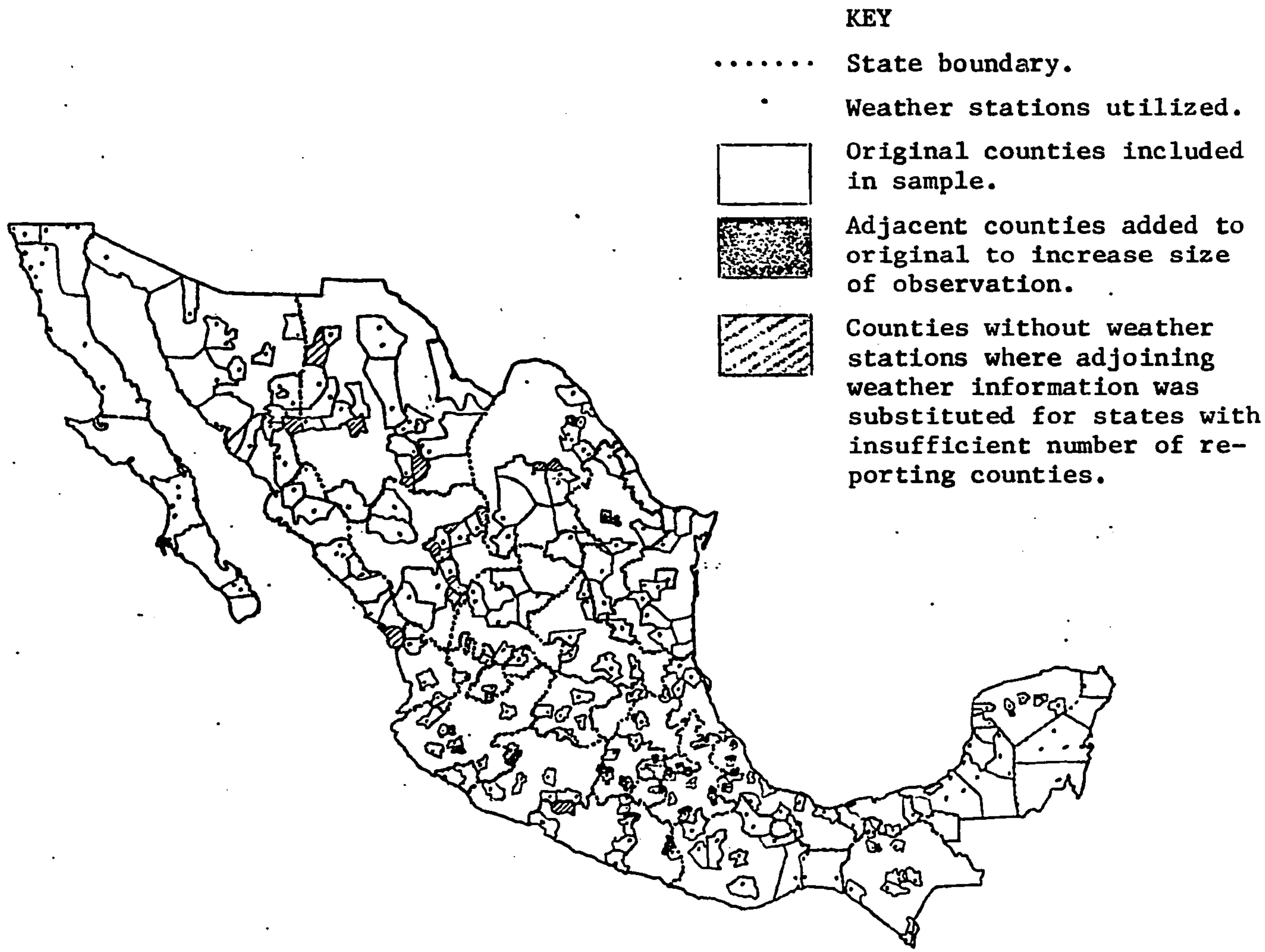


Figure 6.1. County and weather station locations for those counties included in regression analysis.

$X_3$ = Percentage of cultivable private holdings of over five hectares which is left idle.

$X_4$ = Capital per cultivable hectare on ejido holdings in the form of construction of buildings, barns, etc.

$X_5$ = Capital per cultivable hectare on private holdings of over five hectares in the form of construction of buildings, barns, etc.

$X_6$ = Capital per cultivable hectare on ejido holdings in the form of irrigation works and equipment.

$X_7$ = Capital per cultivable hectare on private holdings of over five hectares in the form of irrigation works and equipment.

$X_8$ = Capital per cultivable hectare on ejido holdings in the form of machinery, implements, tools, etc.

$X_9$ = Capital per cultivable hectare on private holdings of over five hectares in the form of machinery, implements, tools, etc.

$X_{10}$= Percentage of total cultivable land in ejido holdings.

$X_{11}$= A measure of aridity in 1959 relative to average aridity over a 20 year period.

$X_{12}$= $(X_{11})^2$, a measure of the combined effects of extreme relative aridity and wet tropical conditions.

$X_{13}$= A measure of average aridity over a 20 year period.

$X_{14}$= $(X_{13})^2$, a measure of the combined effects of extreme average aridity and wet tropical conditions.

$X_{15}$= A measure of labor per cultivable hectare utilized on private holdings of over five hectares in the form of owner labor.

$X_{16}$= A measure of labor per cultivable hectare utilized on private holdings of over five hectares in the form of sharecrop labor.

$X_{17}$= A measure of labor per cultivable hectare utilized on private holdings of over five hectares in the form of hired labor.

$X_{18}$= A measure of labor per cultivable hectare utilized on private holdings of over five hectares in the form of "other" labor.

$X_{19}$= A measure of labor per cultivable hectare utilized on ejido holdings in the form of ejidatario owner labor.

$X_{20}$= A measure of labor per cultivable hectare utilized on ejido holdings in the form of family labor other than owner labor.

$X_{21}$= A measure of labor per cultivable hectare utilized on ejido holdings in the form of hired labor.

$X_{22}$= Percentage of total cultivable land in private holdings of over five hectares on which fertilizer application was practiced.

$X_{23}$= Percentage of total cultivable land in ejido holdings on which fertilizer application was practiced.

$X_{24}$= Amount of privately owned land susceptible to cultivation but as yet unopened to cultivation as a percentage of cultivable land in private holdings of over five hectares.

$X_{25}$= Amount of ejido land susceptible to cultivation but as yet unopened to cultivation as a percentage of cultivable land in ejido holdings.

$X_{26}$= A measure of the number of cattle held by ejidatarios.

$X_{27}$= A measure of the number of cattle held by private farmers with holdings of over five hectares.

It is to be noted that several variables included in the state level models have been excluded from county level consideration. The percentage of cultivable land which is actually irrigated has been omitted. Exclusion of this variable was necessitated by lack of census tabulation of this information at the county level. Results at the state level for the irrigation variable revealed low t values and suggested the irrigation variable was not important in explaining the occurrence of idle land.

The pasture variable used as a proxy for topography is also omitted, due to lack of census tabulation at the county level. However, the weakness of the measurement as an indication of census misclassification is such that its omission is not considered a significant loss to the county level models.

The variables which measure the ratio of urban to rural minimum wages, and the percentage of a states' area within circles of influence of large cities have also been omitted. These two proxy variables for off-farm employment opportunities are viewed as applicable only to the state level and inappropriate for county level models. No alternative measure of off-farm employment opportunities for the county level was found. Since results at the state level suggested that these variables were of little importance in explaining the occurrence of idle land, omission of these variables is again not considered a significant limitation in the county level models.

2. Results and interpretation of county level regression analysis

Multiple regression results for the county level models are presented in Table 6.4. Correlation coefficients, standard errors and the associated Students' t values for the independent variables are presented along with the square of the multiple regression coefficient, $R^2$, and tabular t values for significance at the one, five and ten percent levels. In all models, the calculated values of the F test for regression are greater than the tabulated F values at the one percent level of significance.

To provide results comparable with the state level models, models Ia and Ib contain multiple regression results with total percent idle land as the dependent variable. These models thus contain the land tenure variable, $X_{10}$. In models IIa, IIb, IIIa, and IIIb, idle land for each tenure classification is used as the dependent variable ($X_2$ or $X_3$), allowing differential effects of non-tenure divisible variables to be examined. Rather than subtracting the "for rotation reasons" portion, total idle land is used as the dependent variable, since explanation of rotated idle land was also desired.

In Tabel 6.5, simple correlation coefficients are presented for the "complete model", model Ib. As with the state level models, instances of relatively high simple correlation coefficients are, in general, easily explained. The simple correlations show little reason to question the validity of the regression results due to multicolinearity. The regression results which follow are presented according to the classification scheme for the diagnostic hypotheses as developed in Chapter IV.

Table 6.4. County level regression results[a]

| | Model | Constant term | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ | $X_{10}$ | $X_{11}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Ia | coefficient | .674 | -.209 | | | .125 | | -.241 | -.122 | |
| | std. error | | .118 | | | .036 | | .046 | .056 | |
| | t | | -1.773 | | | 3.433 | | -5.251 | -2.178 | |
| Ib | coefficient | .617 | -.175 | .020 | -.027 | .087 | -.196 | -.239 | -.111 | .006 |
| | std. error | | .130 | .095 | .099 | .042 | .118 | .062 | .064 | .005 |
| | t | | -1.338 | .213 | -.277 | 2.081 | -1.656 | -3.855 | -1.739 | 1.122 |
| IIa | coefficient | .618 | | | | | | -.169 | | .004 |
| | std. error | | | | | | | .041 | | .002 |
| | t | | | | | | | -4.124 | | 1.954 |
| IIb | coefficient | .569 | | -.081 | | .046 | | -.230 | | .006 |
| | std. error | | | .101 | | .036 | | .062 | | .005 |
| | t | | | -.800 | | 1.274 | | -3.692 | | 1.088 |
| IIIa | coefficient | .523 | -.219 | | | | -.387 | | | |
| | std. error | | .141 | | | | .091 | | | |
| | t | | -1.520 | | | | -4.236 | | | |
| IIIb | coefficient | .461 | -.219 | | .122 | | -.495 | | | .006 |
| | std. error | | .149 | | .116 | | .123 | | | .006 |
| | t | | -1.468 | | .968 | | -4.043 | | | 1.091 |

[a]Tabular t values: $t_{.10} = 1.659$, $t_{.05} = 1.980$, $t_{.01} = 2.617$.

Table 6.4. (Continued)

| | Model | $X_{12}$ | $X_{13}$ | $X_{14}$ | $X_{15}$ | $X_{16}$ | $X_{17}$ | $X_{18}$ | $X_{19}$ | $X_{20}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Ia | coefficient | | | | | -2.272 | -.303 | | | -.222 |
| | std. error | | | | | .670 | .121 | | | .095 |
| | t | | | | | -3.393 | -2.499 | | | -2.328 |
| Ib | coefficient | -.476(-04) | .480(-04) | -.270 (-08) | -.234 | -1.953 | -.331 | .614 | .010 | -.223 |
| | std. error | .583(-04) | .339(-04) | .262(-08) | .169 | .716 | .126 | .309 | .141 | .140 |
| | t | -.818 | 1.416 | -1.030 | -1.388 | -2.728 | -2.620 | 1.986 | .070 | -1.591 |
| IIa | coefficient | | | | -.538 | -3.029 | -.758 | .647 | | |
| | std. error | | | | .166 | .751 | .124 | .308 | | |
| | t | | | | -3.249 | -4.034 | -6.101 | 2.104 | | |
| IIb | coefficient | -.177(-4) | .423(-04) | -.302(-08) | -.460 | -3.137 | -.726 | .567 | | |
| | std. error | .634(-04) | .340(-04) | .272(0-8) | .178 | .764 | .126 | .327 | | |
| | t | -.279 | 1.244 | -1.108 | -2.591 | -4.104 | -5.750 | 1.735 | | |
| IIIa | coefficient | | | | | | | | | -.313 |
| | std. error | | | | | | | | | .113 |
| | t | | | | | | | | | -2.779 |
| IIIb | coefficient | -.564(-04) | .185(-04) | -.631(-09) | | | | | -.125 | -.240 |
| | std. error | .672(-04) | .359(-04) | .288(-08) | | | | | .159 | .153 |
| | t | -.839 | .516 | -.219 | | | | | -.788 | -1.569 |

Table 6.4. (Continued)

| | Model | $X_{21}$ | $X_{22}$ | $X_{23}$ | $X_{24}$ | $X_{25}$ | $X_{26}$ | $X_{27}$ | $R^2$ | Degrees freedom |
|---|---|---|---|---|---|---|---|---|---|---|
| Ia | coefficient | -.804 | | | | .780 | | | .357 | 187 |
| | std. error | .204 | | | | .259 | | | | |
| | t | -3.946 | | | | 3.013 | | | | |
| Ib | coefficient | -.696 | -.013 | .065 | -.098 | .993 | -.081 | .019 | .409 | 172 |
| | std. error | .237 | .041 | .030 | .128 | .286 | .158 | .058 | | |
| | t | -2.936 | -.324 | 2.134 | -.767 | 3.473 | -.513 | .328 | | |
| IIa | coefficient | | -.110 | | | | | | .399 | 189 |
| | std. error | | .039 | | | | | | | |
| | t | | -2.837 | | | | | | | |
| IIb | coefficient | | -.095 | | .196 | | | .025 | .419 | 182 |
| | std. error | | .040 | | .141 | | | .063 | | |
| | t | | -2.393 | | 1.386 | | | .388 | | |
| IIIa | coefficient | -.290 | | .094 | | | | | .233 | 191 |
| | std. error | .229 | | .032 | | | | | | |
| | t | -1.266 | | 2.925 | | | | | | |
| IIIb | coefficient | -.255 | | .107 | | .240 | .017 | | .249 | 183 |
| | std. error | .254 | | .034 | | .300 | .169 | | | |
| | t | -1.005 | | 3.098 | | .801 | .101 | | | |

Table 6.5. County level simple correlation coefficients derived from model Ib

| Variable: | $X_1$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ | $X_{10}$ | $X_{11}$ | $X_{12}$ | $X_{13}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $X_1$ | 1.000 | | | | | | | | | | |
| $X_4$ | -.189 | 1.000 | | | | | | | | | |
| $X_5$ | -.187 | .155 | 1.000 | | | | | | | | |
| $X_6$ | -.089 | .244 | .129 | 1.000 | | | | | | | |
| $X_7$ | -.138 | .109 | .418 | .298 | 1.000 | | | | | | |
| $X_8$ | -.230 | .300 | .309 | .408 | .680 | 1.000 | | | | | |
| $X_9$ | -.353 | .190 | .463 | .271 | .652 | .638 | 1.000 | | | | |
| $X_{10}$ | -.173 | -.126 | .146 | -.073 | -.007 | -.189 | .102 | 1.000 | | | |
| $X_{11}$ | .021 | -.046 | .104 | -.054 | .100 | .076 | .071 | .129 | 1.000 | | |
| $X_{12}$ | .022 | -.034 | .042 | -.031 | .012 | .004 | -.007 | .114 | .905 | 1.000 | |
| $X_{13}$ | -.116 | .082 | .071 | .267 | .285 | .527 | .511 | -.051 | -.026 | -.040 | 1.000 |
| $X_{14}$ | -.111 | .033 | .045 | .114 | .111 | .377 | .370 | -.011 | .005 | -.010 | .907 |
| $X_{15}$ | -.148 | .075 | .354 | -.026 | .119 | -.026 | .235 | .123 | .099 | .011 | -.038 |
| $X_{16}$ | -.192 | -.122 | -.140 | -.046 | -.099 | -.198 | -.150 | .067 | -.082 | -.058 | -.097 |
| $X_{17}$ | -.170 | .033 | .159 | -.003 | .100 | .057 | .159 | .251 | .004 | -.015 | -.020 |
| $X_{18}$ | -.021 | .068 | .422 | .013 | .286 | .128 | .331 | .062 | .102 | .022 | .122 |
| $X_{19}$ | -.126 | .229 | .203 | .128 | .089 | .123 | .021 | -.149 | -.045 | -.022 | -.092 |
| $X_{20}$ | -.278 | .296 | .279 | .097 | .031 | .079 | .064 | -.032 | -.014 | .014 | -.053 |
| $X_{21}$ | -.224 | .106 | .296 | .128 | .612 | .617 | .304 | -.116 | .106 | .055 | .112 |
| $X_{22}$ | -.184 | .258 | .225 | .081 | .153 | .064 | .278 | .288 | -.009 | -.029 | .036 |
| $X_{23}$ | -.051 | .280 | .152 | .277 | .467 | .517 | .295 | -.210 | -.023 | -.021 | .135 |
| $X_{24}$ | -.004 | -.048 | -.055 | -.082 | -.108 | -.137 | -.142 | .038 | .001 | -.023 | -.115 |
| $X_{25}$ | .107 | .061 | .132 | .050 | .123 | .169 | .007 | .034 | .051 | .029 | -.125 |
| $X_{26}$ | -.103 | .155 | .113 | -.036 | -.147 | -.108 | -.004 | -.077 | .039 | .004 | -.226 |
| $X_{27}$ | -.097 | -.031 | .337 | -.105 | -.034 | -.082 | .067 | .061 | .003 | -.008 | -.205 |

Table 6.5. (Continued)

| Variable: | $X_{14}$ | $X_{15}$ | $X_{16}$ | $X_{17}$ | $X_{18}$ | $X_{19}$ | $X_{20}$ | $X_{21}$ | $X_{22}$ | $X_{23}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $X_{14}$ | 1.000 | | | | | | | | | |
| $X_{15}$ | -.038 | 1.000 | | | | | | | | |
| $X_{16}$ | -.068 | .116 | 1.000 | | | | | | | |
| $X_{17}$ | .003 | .113 | -.041 | 1.000 | | | | | | |
| $X_{18}$ | .078 | .812 | -.045 | .083 | 1.000 | | | | | |
| $X_{19}$ | .088 | .141 | .091 | -.020 | .100 | 1.000 | | | | |
| $X_{20}$ | -.013 | .133 | .050 | -.016 | .016 | .696 | 1.000 | | | |
| $X_{21}$ | .033 | .075 | -.067 | .034 | .128 | .262 | .265 | 1.000 | | |
| $X_{22}$ | .051 | .088 | -.094 | .093 | .089 | .228 | .344 | .070 | 1.000 | |
| $X_{23}$ | .051 | -.032 | -.071 | .061 | .022 | .356 | .233 | .427 | .093 | 1.000 |
| $X_{24}$ | -.051 | -.027 | .017 | -.051 | -.091 | -.059 | -.058 | -.057 | -.083 | -.093 |
| $X_{25}$ | -.073 | -.026 | -.201 | .323 | -.031 | .167 | .073 | .306 | .136 | .095 |
| $X_{26}$ | -.119 | .266 | .095 | -.074 | .085 | .305 | .288 | .007 | .077 | -.038 |
| $X_{27}$ | -.094 | .100 | .061 | .051 | .063 | .181 | .139 | .001 | .143 | -.097 |

| Variable: | $X_{24}$ | $X_{25}$ | $X_{26}$ | $X_{27}$ |
|---|---|---|---|---|
| $X_{24}$ | 1.000 | | | |
| $X_{25}$ | -.021 | 1.000 | | |
| $X_{26}$ | -.059 | .217 | 1.000 | |
| $X_{27}$ | .047 | .035 | .230 | 1.000 |

a. Variables directly controllable by the firm

Hypothesis 1.1: As the amount of capital per cultivable hectare increases, the amount of idle land will decrease:

When the capital variable is disaggregated into three of its components, i.e., construction, machinery, and irrigation equipment, some interesting results appear. The irrigation portion is analyzed under Hypothesis 2.1. Construction and machinery capital are considered below.

Capital per cultivable hectare in the form of construction works in the private sector had everywhere such low t values that the correlation coefficient could not be considered different from zero. Although *ejido* construction capital is significant at the 10 percent level only in model Ia, the t values are consistently high enough in models IIIa, IIIb and Ib to suggest that this *ejido* capital variable should not be completely disregarded as a possible explanation for idle land.

The possible differences by land tenure class are easily explained. The private sector has twice the average amount of construction capital per hectare found in the *ejido* sector. As mentioned in the state level section, the private sector was left with greater amounts of construction capital by the method of land redistribution which allowed selecting the desired portion of holding to be retained before expropriation. Also, credit availability for construction may be greater in the private sector.

Construction capital may be more closely related to livestock raising activities than the other capital components. To the extent this is true, the possible bias arising from capital utilized on non-cultivated holdings mentioned for the state level capital measure would be isolated--especially for the private sector[216]. If construction capital is associated with livestock-raising activities, an explanation is available why construction capital limitations might result in more idle land in the ejido. Lacking access to such capital, livestock activities might be preempted. Thus, pasture land is lost as a viable alternative to the practice of rotating idle and cultivated land.

Results of the machinery capital variable are found to support Hypothesis 1.1. The machinery capital variables for both the private and ejido sectors are significant at the one percent level in all models with the exception of models Ia and Ib for the ejido sector (which are less appropriate for testing reasons for idle land in that sector). In all cases, the correlation coefficients are negative as hypothesized. The significant machinery capital variable for the ejido sector is not surprising since this completely agrees with the state level results. However, the significance of the machinery capital variable may be somewhat more surprising for the private sector, in that the capital variable covered up the influence of the machinery portion as an important explanation of idle land in the private sector.

It is unfortunate that a measurement of capital in the form of

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[216]This is also suggested by the simple correlation coefficients. The simple correlation coefficient between livestock number and construction capital is .337 in the private sector ($X_5$,$X_{27}$) whereas it is only .155 for the ejido sector ($X_4$,$X_{26}$).

animal power was not obtained, since there is reason to suspect that animal power is even more important than machinery as a factor contributing to idle land[217]. This applies especially to the *ejido* sector and the small private farms.

In summary, the following relationships between idle land and the capital variables were found: Increased capital per cultivable hectare in the form of construction works was not significant in the private sector, but could be of possible importance to the *ejido* sector. Increased capital per cultivable hectare in the form of machinery, equipment, and tools was found to be the most important portion of capital explaining idle land. Furthermore, it seems to be a limiting factor in both the *ejido* and private sectors. Evaluation of the importance of animal power capital must be deferred until the case study section.

*Hypothesis 1.2: As the amount of labor utilized per cultivable hectare is increased, the amount of idle land will decrease:*

For the private sector, findings for the labor variables are generally consistent with state level model results. High t values are found in all models, with negative coefficients as hypothesized for producer, share-crop, and hired labor. These coefficients are significantly different from zero at the one percent level in all cases, except model Ib for producer labor.

The "other labor" category in the private sector is of opposite to hypothesized sign, being positive and significantly different from zero

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[217] See pp. 91-92.

at the five percent level in models Ib and IIa. This result is difficult to explain. In the first place, what such labor would include is unknown. A possible explanation could be found if this type of labor were more peculiar to livestock operations. In that case, a spurious positive relationship between this labor variable and idle land could result if pasture lands were incorrectly classified as cultivable, but idle.

The proportion of labor in the "other labor" category is only 12 percent of the total. Thus, the overall labor picture for the private sector supports the state level findings. The amount of labor utilized by the private sector is again found important in determining the amount of idle land. These results again support the _latifundio_ hypothesis as against Hypothesis 2.2[218].

As with capital in the private sector, labor in the _ejido_ sector is not entirely what would be expected when compared to the aggregate labor variable findings at the state level. The _ejido_ owner component of the labor variable is consistent with state level results. The correlation coefficient is not significantly different from zero. However, the amount of family labor and hired labor utilized by the _ejidatario_ appears to have a different effect from that expected. For both the family and hired labor variables, the correlation coefficient t values are sufficiently high in all models (except hired labor in model IIIb) to suggest labor is important in both the _ejido_ and the private sector in explaining

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[218] See p. 144 for a previous discussion of the _latifundio_ hypothesis.

idle land. The results suggest that the ejido owner component of total ejido labor was strong enough to mask the influence of family and hired labor at the state level.

Hypothesis 1.3: As the level of technology adopted increases, the amount of idle land will decrease:

As in the state level models, fertilizer application is again used as a proxy variable for the level of technology adopted[219]. Results of the fertilizer variable contradict previous state level results, and are therefore difficult to interpret. For the private sector, the correlation coefficient signs are negative as hypothesized, with t values significant at the one percent and five percent levels respectively for models IIa and IIb, although the correlation coefficient is not significantly different from zero in model Ib. Thus, it would appear possible that adoption of new technology by the private sector is important in decreasing the amounts of idle land, but for some reason its importance is covered up in the state level models. If so, the previous interpretation given to the ejido results also applies to the private sector. That is, the private sector also fails to adopt new inputs which would decrease the incidence of idle land.

County level results for the ejido sector are especially difficult to explain. In contrast to state level results which were not significant at the five percent level, the county level correlation coefficients are opposite to hypothesized sign (positive) and significantly different

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[219] Limitations inherent in the fertilizer measurement are discussed on p. 141.

from zero at the one percent level in models IIIa and IIIb, and at the five percent level in model Ib.

If there were increasing returns to capital for the ejido sector, as suggested in the state and county level findings, it is possible that one of the first expenditures would be for fertilizer. Thus, as an ejidatario concentrated his capital (in the form of fertilizer) on part of his holdings, the rest of the holdings would be left idle, and a positive relation would be found between fertilizer use and idle land for the ejido sector. However, the results for the fertilizer variable must be considered inconclusive for the ejido sector.

b. Variables outside the direct control of the firm

Hypothesis 2.1: Areas of greater irrigation development will tend to have less idle land:

In the absence of county level data relating to area actually irrigated, capital per cultivable hectare in the form of irrigation works and equipment was used as a proxy variable to indicate greater levels of irrigation development.

The following results were found for the irrigation capital variables. In the ejido sector, the variable is not significantly different from zero, having low t values and opposite signs in models IIb and Ib. In the private sector, the t values were significant at the five and one percent levels respectively in models Ib and Ia, although not significantly different from zero in model IIb. Surprisingly, in all cases positive coefficients were found. This would indicate that as expenditures on irrigation increase, idle land also increases.

A satisfactory explanation of the results is difficult, since they contradict the state level findings. It is therefore unfortunate that county level information about land actually irrigated was not available to help clarify the conflicting findings. It was previously suggested that irrigable land (and thus cultivable but idle) increased more rapidly than that actually irrigated, expecially in the *ejido* sector[220]. Results at the county level tend to contradict this explanation.

It is possible that the "hotel room hypothesis" of land misclassification applies; that is, that a certain amount of censusing is done away from the farms without actually interviewing the farm owner. Such an argument would hold that there are areas where irrigation works exist side by side with large holdings of extensively farmed land. The census enumerator, noticing the cultivated land and high amounts of irrigation, considers neighboring land as cultivable but idle rather than "susceptible to cultivation". In such a case, a negative simple correlation coefficient would be expected between land susceptible to cultivation and irrigation capital ($X_7$,$X_{24}$). Although this is found to be so, the simple correlation is too low (-.108) to provide much support for this argument.

The argument that increasing marginal returns to irrigation capital may exist is also unconvincing. This argument suggests increased irrigation could cause limited capital or labor to be shifted from unirrigated cultivable land to irrigated land, resulting in unirrigated cultivable

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[220]See pp. 142-143.

land being left idle. However, the higher levels of capital are found in the private sector, not the ejido sector!

It is suspected that measurement of irrigation capital is more difficult for the census enumerator than the other capital variables. Hence, this measure could be less reliable than the "actually irrigated" measurement used at the state level.

To sum up, the difficulty of providing an explanation for the contradictory nature of the county and state level results, makes it inadvisable to confirm or reject Hypothesis 2.1 at this time. There is evidence for both the ejido sector (at the state level), and the private sector (at the county level) to indicate a positive relationship between idle land and irrigation. However, stronger, non-contradictory tests would be required before a positive relationship could be accepted in lieu of Hypothesis 2.1.

Hypothesis 2.2: Areas of heavier ejido concentration will tend to have higher amounts of idle land:

Even though the land tenure correlation t values are somewhat smaller than those of the state level models, they are still significant at the five and ten percent levels in models Ia and Ib respectively. The coefficients are again opposite in sign to that hypothesized, and are large enough to suggest that idle land is more likely to be caused by the private than the ejido land tenure system.

The signs of the simple correlation coefficients between private land ownership and the capital, labor, and fertilizer variables again support the latifundio hypothesis. However, similar signs in the ejido sector weaken some of the force of this argument. Even so, little support is found for Hypothesis 2.1 as an alternative to the latifundio hypothesis.

c. Largely uncontrollable variables

Hypothesis 3.1: Long-run weather characteristics are not significant in explaining idle land:

As with the state level models, the t values for the correlation coefficients of average weather and average weather squared are quite low. Thus, with improved preciseness of weather information, support continues to be found for Hypothesis 3.1, suggesting that regional differences based on long-run weather conditions are not important in determining idle land.

Hypothesis 3.2: Greater amounts of idle land will occur in areas of unseasonable weather:

Idle land can be considered as comprised of two portions - one arising from permanent or long-run influences. The other arising from more transitory or short-run influences (such as relative weather). The signs of the relative weather coefficients were in all cases positive as hypothesized and as found in the state level models. The t values were lower in the county level models, with correlation coefficients not significantly different from zero at the five percent level in any model.

In the county level models, the relative weather variable was also utilized in its squared form. In this way, the combined effects of unseasonable aridity and unseasonable wet tropical conditions could be examined. The signs of the correlation coefficients are negative as would be hypothesized, but the t values below those of the simple relative weather variable. This suggests that little is gained from including extremely moist tropical conditions in the model.

Given the hypothesized correlation signs and the state level findings, relative weather should probably not be completely ruled out as a possible influence on idle land, despite lower t values. However, these lower values were surprising, since it was anticipated that refinement of the weather measurement would increase the significance of this variable.

<u>Hypothesis 3.3: Greater amounts of idle land will be encountered when land holdings are of poorer quality:</u>

Land susceptible to cultivation but as yet unopened to cultivation is again used as a proxy variable for land quality. County level results lend strong support to those of the state level. The signs of the <u>ejido</u> sector coefficients are again positive in all cases, and t values are significant at the one percent level for models Ia and Ib, although lower in model IIIb.

Except for the positive sign in model IIb, private sector results are also as found at the state level. The correlation coefficient signs are again not significantly different from zero, suggesting land of marginal quality may be alternately cultivated and left idle by the <u>ejido</u> sector, but is not included in the cultivated base of the private sector.

Hypothesis 3.4: Systematic biases in census reporting can be detected which explain idle land levels reported:

Due to the census bureau failure to tabulate pasture information at the county level, this proxy measure for topography had to be discarded. In its place, the number of cattle per hectare of cultivable plus pasture lands was used as an indication of the extent to which cattle operations prevailed over cultivation activities. A positive correlation between idle land and number of cattle was assumed to indicate a greater likelihood of misclassification of the pasture lands as cultivable but idle, rather than as susceptible to cultivation. The low t values indicate that the correlations are not significantly different from zero for either land tenure class. Difficulties in interpreting the influence of the pasture portion in the denominator of the livestock variable may explain the non-significant results.

The county sample had considerably higher amounts of land susceptible to cultivation in the private sector than in the *ejido* sector. Thus, the "hotel room" misclassification argument discussed under state level results appear less likely for those counties sampled.

In summary, due in part to the scarcity of data at the county level, less support for census misclassification of idle lands could be found than at the state level. However, some suspicions are raised by the results discussed earlier of the "other labor" and irrigation capital variables for the private sector.

### C. Interpreting and Extending Results Through Case Studies

In an effort to interpret and extend the statistical analysis based largely on census data, case studies were undertaken in two areas. Information for the case study was obtained through use of an in-depth questionnaire which was completed with a sample of 51 farm operators (see Appendix III for a copy of the questionnaire). The sample was divided approximately equally between the two counties of Apatzingán and Alvarado, located in the states of Michoacán and Veracruz, respectively. The counties were selected according to the following criteria: high amounts of idle land reported in the census, approximately equal representation of private and ejido tenure classes, and different climatic conditions. Numbers sampled for the private and ejido land-tenure classes were 23 and 28 respectively.

Besides the questionnaire responses, information was gathered through interviews conducted with additional farm operators in a less structured way. By departing from the format of the in-depth questionnaire, further insights and interpretations regarding idle lands could be obtained. Questions most relevant to the idle land problem were retained, but more opportunity was afforded for discussion of regional and individual farm problems, and speculation about the extent of, and reasons for, idle land among their neighbors.

The nature of the information collected by the case-study approach is of necessity qualitative rather than quantitative. That is, the numbers involved are not sufficient to provide for statistical tests.

Yet recurring qualities were found which appear to be important as information supplementary to the regression results. It is also felt that the generation of original data, meager though it be, is an important contribution in a country where such data is so scarce, especially for areas as isolated as those of the case studies. The section which follows describes some of the characteristics of the case-study areas. In the second section, the diagnostic hypotheses formulated in Chapter IV are tested against the case-study results.

1. Description of the case-study areas and sample determination

a. Apatzingán, Michoacán The county of Apatzingán is located near the center of the state of Michoacán (see Figure 5.2). Together with the counties of Buenavista Totatlán, La Huacana, Parácuaro, Tepalcatepec, Zaragoza, and Gabriel Zamora, Apatzingán forms the region within the State of Michoacán appropriately known as "Tierra Caliente", or "hot lands". The State of Michoacán, lying on the western portion of the country and bordering the Pacific Ocean, is considered part of the Central Zone of Mexico.

Topography of the county tends to be flat. The Sierras de Apatzingán which form part of the Sierra Madre del Sur influence topography, with some rolling land and elevations of over 1000 meters at the extreme northern and southern ends of the county. Topography and soil type lend themselves to cultivation[221].

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[221]Hernández, Millares, Jorge and Carrillo Escribano, Alejandro. Atlas Porrúa de la República Mexicana. Editorial Porrúa. México. 1966.


Figure 6.2. Map of Mexico showing location of the state of Michoacán and the county of Apatzingán.

The climate is hot and arid to semi-arid, according to the Thornthwaite classification. A well-defined winter season is lacking. Rainfall occurs during summer and fall, the rest of the year being quite dry[222]. Although dry farming is possible, yields and length of growing season are greatly enhanced by irrigation.

The county's principal city of Apatzingán has a population of approximately 20,000. A striking characteristic of the city is the predominance of commercial agricultural supplies and services as seen in the machinery, fertilizer and insecticide salesrooms; storage and shipping facilities; cotton gins and agricultural processing industries.

Communication networks terminate in the southwest portion of Michoacán in the city of Apatzingán. There the paved highway ends, as does a railroad line; only dirt roads lead beyond the city. The lack of transportation is an important barrier to improved production and marketing of agricultural products, especially during the rainy season.

Apatzingán is typical of a region undergoing extremely rapid agricultural transformation. Historically an important cattle raising region, the livestock industry is being crowded from three sides: from illegal "paracaidista" ("paratrooper" or squatter) occupation and harassment; from irrigation and land development in the private sector; and from the governmental policy of non-renewal or expropriation exemptions previously granted for grazinglands. Thus, the region has rapidly been

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[222]Contreras Arias, Alfonso. Mapa de las provincias climatológicas de la República Mexicana. Secretaría de Agricultura y Fomento. Dirección General de Geografía, Meteorología e Hidrología. Instituto Geográfico. México. 1962.

transformed into an irrigated commercial agricultural region, with cotton, fruit, and vegetable exports grown under modern conditions, often with heavy machinery inputs. Numerous underground irrigation wells attest to the progressive nature of agriculture. Rather than depending entirely on the usual governmental development of surface water, this underground water has been developed by private initiative.

As might be expected from its rapid transformation, Apatzingán has many appearances of a "frontier settlement": frequent violence, prominent display of small arms, and the repeated necessity of government troops to maintain order. In addition, much of the population in the area is of recent arrival and exhibits considerable mobility.

A high incidence of idle land was reported in the 1960 Agricultural Census for the county. Furthermore, the major portion of this idle land was unexplained (i.e., was not used in a crop-rotation scheme). The idle-land situation is indicated in Table 6.6.

Over 80 percent of the cultivable land was reportedly left idle. The largest part was found in the private sector with holdings over five hectares. This sector left over 90 percent of its cultivable land idle, while the *ejido* left two-thirds idle. In the *ejido*, nearly all the land was left idle for undetermined reasons, whereas in the private sector approximately one-half was due to rotation practices.

In addition to the possibility of examining the influence of transportation, climate, and rapid agricultural transformation on the incidence of idle land, the county of Apatzingán had other appealing characteristics

Table 6.6. Idle land reported for the county of Apatzingán, by tenure class, 1960[a]

| Land tenure class | Total cultivable land (hectares) | Total idle land (hectares) | Percent idle land | Percent idle for rotation reasons | Percent idle for undetermined reasons |
|---|---|---|---|---|---|
| Private holdings over five hectares | 42,043 | 38,026 | 90.44 | 41.12 | 49.32 |
| Private holdings, five hectares and under | 205 | 202 | 98.54 | 0 | 98.54 |
| Ejido | 33,302 | 22,286 | 66.92 | 3.25 | 63.67 |
| Total | 75,550 | 60,514 | 80.10 | 24.32 | 55.78 |

[a]Source: Secretaría de Industria y Comercio. Dirección General de Estadística. Cuarto Censos. Resúmenes Estatales. op. cit., Estado de Michoacán. Cuadro 5.

enhancing its desirability for case study. Both cultivable and irrigated lands were evenly divided between the ejido and private sectors. Another advantage was access to a randomly drawn sample of private farmers and ejidatarios utilized by the Centro de Investigaciones Agrarias.

Unfortunately, once in the field it was found that mobility of the population, especially among small private farmers, was so great that substantial deviation from the random sample list was required.

Location of the ejido settlements in Apatzingán was determined by a map secured from the Registro Nacional de Electores. Ejidos were chosen for interviews which would provide as wide a geographical distribution as possible. Special effort was made to visit the more isolated ejidos, since higher amounts of idle land were suspected to be associated with them. For the private sector, as many types of farming operations as possible were included in the interviews: fruit and vegetable crops, cotton, grain, cattle raising, etc.[223].

b. Alvarado, Veracruz The county of Alvarado is situated near the southeast portion of the state of Veracruz (see Figure 6.3). Veracruz is one of the states which comprise the Gulf of Mexico zone. The state is bordered on the east by the Atlantic Ocean, and on the west by the Sierra Madre Oriental mountain range. This mountain range gives the state great variation in climate and topography.

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[223]A similar criterion was used for selection of the ejidos and individuals in the Alvarado case study. The final sample for both areas underrepresents irrigated ejido lands and small private holdings under five hectares.


Figure 6.3. Map of Mexico showing location of the state of Veracruz and the county of Alvarado.

The county of Alvarado has the same latitude as Apatzingán, but is located at the longitudinal extreme of the country, lying next to the Atlantic Ocean. Topography is level to slightly rolling, with all land being within the 0-200 meter elevation[224].

The principal city is Alvarado, with approximately 13,000 inhabitants. It is located close to the large seaport city of Veracruz, and also close to a small sugar refinery at Lerdo de Tejada. Alvarado is a port city and contains an important cooperative fish-marketing pilot project.

Vegetation in the area is chiefly tropical forest and coastal mangroves. The soils are formed under humid tropical conditions which lack oxygen, with subsurface water usually near to the surface. They are reportedly fertile and are characteristic of the principal agricultural regions of the state. They are often of alluvial origin and associated with level topography[225].

A principal reason for selecting Alvarado was to study idle land under climatic conditions different from those of Apatzingán. According to the Thornthwaite classification, Alvarado varies from hot and humid to very humid[226]. Temperature extremes are less than in Apatzingán, the

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[224] Hernández Millares. op. cit.

[225] Información general del estado de Veracruz. Instituto de Ciencias. Vol. 1 and 2. Univ. of Veracruz. Jalapa, México. 1962.

[226] Contreras Arias. op. cit.

average monthly highs ranging from 2.4°C. to 9.5°C. cooler, and the average monthly lows from 0.3°C. to 2.6°C. warmer. Average monthly relative humidity measurements were never under 70 percent, whereas in Apatzingán, relative humidity is under 50 percent most of the year, approaching 70 percent only during the months of July-September. Rainfall in Alvarado averages nearly 2,000 m.m. annually, compared to only 700 m.m. in Apatzingán[227]. Both a well-differentiated winter and dry season are lacking. Aridity indices place Alvardo in the very humid class, compared to the semi-arid class for Apatzingán[228].

Communication facilities of Alvarado were similar to those encountered in Apatzingán. Although an excellent paved highway connects the city of Alvarado with Veracruz and continues south along the coast, a secondary road network is decidedly lacking, being even less adequate than in Apatzingán. A railroad line terminates in Alvarado as was the case of Apatzingán. The lack of secondary roads, together with the rainy season, make outlying settlements extremely isolated for a large part of the year.

Cultivation practices differ from those of Apatzingán. Irrigation is rare, although major governmental irrigation projects are found nearby. Moisture is sufficient for non-irrigated agriculture, although irrigation would allow double cropping and often higher yields. Intensive

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[227] Soto Mora, Consuelo and Jáuregui O., Ernesto. Cartografía de elementos bioclimáticos en la República Mexicana. Universidad Nacional Autónoma de México. Instituto de Geografía. Mexico. 1968.

[228] Soto Mora and Jáuregui O. Isotermas. <u>op. cit.</u>

cultivation, crop diversification, and export crops are not common; thus Alvarado lacks the commercial agricultural supplies and services so predominant in the city of Apatzingán. Both the rapid transition in agriculture and the frontier atmosphere of Apatzingán are noticeably absent. A cattle-raising tradition is shared by both regions, Alvarado being located in the heart of the cattle-raising area in the traditionally important cattle-raising state of Veracruz. Fishing is also an important activity in the county[229].

Although climatic conditions and cultivation practices are quite different in the two regions, both have a relatively high incidence of idle land according to the 1960 Mexican Agricultural Census. The idle-land situation in Alvarado is summarized in Table 6.7. Nearly 50 percent of the cultivable land was reportedly left idle. The largest part was again found in the private sector. However, contrary to Apatzingán, it was the ejido sector with half of its idle land "in rotation", and the private sector was nearly all idle land left for "other undetermined reasons".

There was no access to a previously compiled random sample or to census ballots as in Apatzingán. In trying to secure a sample which would represent the types of agricultural activities of the area, officers and non-officers of a number of ejidos located in various parts of the county were interviewed along with private sector individuals who were selected from grower association lists (membership in which is

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[229] Información general del estado de Veracruz. op. cit.

Table 6.7. Idle land reported for the county of Alvarado, by tenure class, 1960[a]

| Land tenure class | Total cultivable land (hectares) | Total idle land (hectares) | Percent idle land | Percent idle for rotation reasons | Percent idle for undetermined reasons |
|---|---|---|---|---|---|
| Private holdings over five hectares | 5,633 | 3,676 | 65.26 | 1.99 | 63.27 |
| Private holdings five hectares and under | 18 | 18 | 100.00 | 0 | 100.00 |
| Ejido | 4,580 | 1,230 | 26.86 | 12.95 | 13.91 |
| Total | 10,231 | 4,924 | 48.13 | 6.89 | 41.24 |

[a]Source: Secretaría de Industria y Comercio. Dirección General de Estadística. Cuarto Censos. Resúmenes Estatales. *op. cit.*, Estado de Veracruz. Cuadro 5.

required by law). Results of the ejido and private sector interviews are presented in the section which follows.

2. Utilization of case study and supporting information in testing the diagnostic hypotheses[230]

To facilitate interpretation of the case-study results contained in this section, the material is organized in the following way: For each diagnostic hypothesis tested, results are described according to the land tenure category[231]; within each land tenure category, presentation of results is further divided as to case study area. This form of exposition was selected because of the greater variation found between land-tenure classes than between geographical areas of the case studies.

Hypothesis 1.1: As the amount of capital per cultivable hectare increases, the amount of idle land will decrease:

1. Ejido sector

a. Apatzingán Without property mortgages as a loan security, special governmental Ejido Banks have been required to provide credit to this sector[232]. In Apatzingán, acute shortages of credit and capital were encountered. For the vast majority, the only capital was a work

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[230]For further explanation of the diagnostic hypotheses and the criteria for classification, see Chapter IV.

[231]In Alvarado, individuals were found who possessed both private and ejido lands. Characteristics of this group are discussed under the private-sector category which they more closely resemble.

[232]Levels of credit extended by the Ejido Bank are discussed on p. 135.

animal, harness and plow, and a few hand tools. Approximately one-half of those interviewed received some credit from the Ejido Bank and another one-quarter got credit from "friends" (charging up to five percent interest monthly). The rest received no credit from any source. Ejidatarios with access to credit were usually more prosperous than the average, and possessed irrigated lands.

Among those interviewed, the average loan made by the Ejido Bank was $4,500 pesos ($360.00 U.S.). The rate of interest charged varied from area to area, ranging from eight to twelve percent. Actual yearly interest rates are significantly higher since these loans are often repaid within six months, yet, according to the recipients, the full year's interest is charged. Urgent need for greater credit is seen in the small number of recipients and the low amounts granted (usually $40.00 U.S. per hectare) as well as in the common practice of using substantial portions for consumption expenditures[233].

Of those receiving loans, nearly all felt these funds were insufficient and most stated that even if the loans were increased, sizeable portions of the increase would still be used for everyday living expenditures. In all cases, credit was viewed as useful. Hence, credit acceptance is an important success element allegedly not found in many

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[233] In one case, a young member of a credit society has used all of his loan in consumption expenditures and was uncertain of his ability to repay the loan from production sales. However, it should be noted that the average Apatzingán ejidatario is considerably better off than the average ejidatario for the nation (see p. 135).

less-developed countries[234].

A complication encountered with the Ejido Bank is its policy of lending to ejido "credit societies". If an individual defaults in repayment, the loan is secured by the remaining members' responsibility to cover the entire loan before the society will be granted credit again. In one case encountered, enough members had defaulted on their loans (which the others could not make up) so that the ejido was unable to continue receiving credit from the Bank. In such cases, the effect of the ejido credit society can be extremely detrimental to the morale and attitudes of individual ejidatarios. Credit-worthy ejidatarios may be discouraged from entering into any credit-society agreement.

In one ejido, the credit-society problem was of a different nature. A group within the ejido had applied for credit, but the ejido president had refused to sign the required papers or help in any way. He had been president for over 10 years, and was accused of trying to keep the area underdeveloped and under his control, much as latifundio owners had done before the Revolution.

With very few exceptions, increased amounts of production credit would be used for traditional inputs of work animals, hired labor, and seed. In rare instances, credit was desired for fertilizer, insecticide, orchard and irrigation development, or machinery.

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[234]On the other hand, a certain inertia exists on the part of some ejidatarios in securing credit. Several stated that credit was useful, that they needed credit, and that they thought the Ejido Bank would loan to them. Yet, they had never applied for credit.

Interestingly, little relation could be found between idle land and credit availability. However, all those with idle land complained that credit received (if any) was insufficient. Thus, some support was found for the increasing returns to capital argument. Credit extended was so limited that it was used for animal power or hired labor on presently cultivated areas, rather than in the more expensive opening of new lands.

b. Alvarado Ejido credit needs in Alvarado were even more acute than in Apatzingán. No instances could be found where the Ejido Bank had made agricultural production loans[235]. Only one case was found where an ejidatario had been able to secure credit from a commercial source[236].

Attitudes towards use of credit were again overwhelmingly favorable. All expressed the opinion that credit was useful and desirable, and all stated present credit was insufficient. In Alvarado, as in Apatzingán, the limited use of credit was due to its unavailability, not to a "traditional attitude" of wariness. In fact, one third had made formal requests for credit, but had been turned down. The remaining two-thirds who had not applied felt they too would be turned down because of lack

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[235] However, some loans had been made to ejidatarios by the Bank to purchase boat motors for fishing.

[236] This case is interesting as an indication of what small amounts of credit might accomplish. The individual had secured a $3000 peso loan from a commercial bank, payable over a three year period with 12 percent interest charged. He was the largest landholder in this ejido group (12 hectares), yet was one of very few who had no idle land.

of loan securities, or felt there was too much red tape involved.

2. Private sector

a. Apatzingán Access to and use of credit by private operators was much greater than for ejidatarios. In Apatzingán only one-third of those interviewed stated they needed more credit than was presently available. Among this one-third, only one case was found where substantial amounts of credit were not already utilized[237].

The average amount of credit used in the private sector was approximately $250,000 pesos, the highest amount found being over two million pesos. Furthermore, it is suspected that these figures contain a downward bias, since underreporting of such financial arrangements can be expected. At any rate, the great disparity between the private and ejido sectors in credit availability and use is obvious.

All idle land was found within the group which stated they received insufficient credit, yet their average holding was only 57 hectares, compared to over 130 hectares for those receiving sufficient credit. The findings lend support to the county regression results which suggested credit use by larger farmers may overshadow the needs of the smaller private farmers. Private banks were apparently not willing to make loans to farmers with small holdings[238].

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[237] It should be noted, however, that in the Apatzingán case, those receiving insufficient credit were nearly always renters or holders of unclear land titles.

[238] A bitter comment often expressed by the smaller farmers in the interviews was that at least the ejido had a government bank, however inadequate for its needs.

In the private sector credit tended to be used for modern inputs--machinery, fertilizers, and insecticides--rather than for labor and animal power. In contrast to the ejido, much credit was used for land development, with heavy land clearing, irrigation, and leveling expenditures having been undertaken.

b. Alvarado The contrast in credit use between the ejido and private sectors in Alvarado was again conspicuous. For the private sector, the average loan was $80,000 pesos, ranging from zero to $400,000 pesos. The amount of capital owned by the private sector was quite high. All had pick-ups or trucks, and many had small tractors to help with mowing operations, land clearing, and other odd jobs. The average number of cattle owned was 365 head, varying from a low of 75 to a high of 850.

It was earlier reasoned that machinery capital in the private sector might have become significant at the county level because the influence of large farmers was lessened[239]. Interview findings are consistent with this assertion. Although larger farmers expressed satisfaction with present levels of credit, the smaller farmers were encountering problems.

For those ejidatarios who were also private farmers, access to credit was the most striking difference which set them apart from the ejido sector. Credit was used by approximately 85 percent of the ejido-private members interviewed. Bank loans to this group averaged $52,000 pesos, with a high of $120,000 pesos[240].

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[239] See p. 168.

[240] Despite the relatively high amounts of credit received, 70 percent of the ejido-private group stated it was insufficient.

Results from the ejido-private group are interesting, since there was only one instance of idle land among this group. In sharp contrast to the high idle land levels in the ejido sector, members of this group were farming most of their private and ejido lands.

Credit and capital case study results help explain the high amounts of ejido idle land found (which contradict census reports of higher incidence in the private sector). The wide differences between the levels of credit and capital in the two sectors lend support to the argument that increasing returns to capital could be found in the ejido sector at the same time that diminishing returns were found in the private sector. Differences in the intended use of additional credit also support this argument. In the ejido, credit would be used for purchase of animal power and hired labor, indicating expansion of present farming activities onto the unused (idle) land. The private sector, on the other hand, would use credit to purchase and improve land and purchase cattle--suggesting little idle land exists in their present land base.

Hypothesis 1.2: As the amount of labor utilized per hectare of cultivable land is increased, the amount of idle land will decrease:

1. Ejido sector

a. Apatzingán A surprising response to the question "What resources are most needed in order to expand your land area under cultivation?" was the frequent mention of the need for hired labor. It was not anticipated that in a supposedly labor-surplus economy nearly one-third of the respondents would state that labor shortage was a problem.

This may be due in part to the greater-than-average isolation of the _ejido_ settlements interviewed.

Although the seasonal peak demand for labor may be difficult to meet locally, the level of unemployment and underemployment during the rest of the year is impressive. The predominant pattern is to work approximately four to five months of the year. At harvest times, a six day work week is usually followed, with laborers working as many as eleven hours per day. During the remainder of the employment period, work decreases to approximately a 20 hour work week, followed by a period of seven to eight months of virtual unemployment.

Even with this low level of employment, the problem is felt to be understated, since the work patterns apply only to landowners. The plight of the landless peasant, with second call on any available work, would be much more severe. In addition, although both average time worked and time worked during rush seasons was asked, it is apparent that in many cases the responses (of both _ejidatarios_ and private owners) were in terms of an upper limit. This may be attributed to lack of knowledge, lack of understanding of the questions posed, or a tendency to boast about the amount of work undertaken.

All interviewed _ejidatarios_ utilized hired labor at some time during the year. In several instances hired labor was utilized on a continuing basis. It would appear that the "family farm ideal" of _ejido_ land being worked only by its owners is not realized even in the smallest of _ejido_ plots in this area. Again, extrapolation to national conditions is dangerous, given the greater isolation of the sampled ejidos compared to the average ejido.

b. Alvarado The ejido labor situation in Alvarado was different in several respects. Seasonal unemployment of owners and hired labor was not nearly as great, due to time-consuming land-clearing activities and the widespread cultivation of rice, with its high labor requirements. Half of those interviewed indicated labor shortages during May-July. Need for increased hired labor was mentioned frequently as a constraint to expansion of cultivated area.

The ejido case-study results suggest that in more isolated ejidos, anticipation of labor shortages during peak periods of need may contribute to limiting the amount of land cultivated. This is true despite very high levels of seasonal unemployment. Although labor shortage was not as critical in Apatzingan as in Alvarado, it was apparent that in both areas it would become important in causing idle land were the size of holdings increased.

2. Private sector

a. Apatzingán The private sector was characterized by much higher employment levels than the ejido. Most private farmers practiced double cropping, and thus were occupied 11-12 months of the year. This was especially true of those farming their own land and whose primary source of income was farming. Those renting land from ejidatarios usually planted only cotton, and were occupied for nine months. Others who farmed as a side operation rented land for three to four months, planting melons for export after the cotton harvest. Besides greater on-farm employment because of the intensive farming practiced, and the large scale of operations, opportunities for off-farm employment were also much higher in the private sector[241].

The main labor problem of consequence to the private sector was difficulty in getting workers to reside at the more isolated ranches. Workers had to be transported from town each day, a difficult and costly operation considering road conditions. Some labor scarcity was also experienced during the peak cotton-harvest period, but was viewed largely as an inconvenience.

The amount and type of labor utilized was also distinct for the private sector. Virtually no female or child labor was utilized in the crop work. Hired labor requirements were quite high. The largest number employed among the respondents was 70 full-time hired laborers; 11 full-time semi-skilled tractor operators; managers or overseers; and 150 laborers hired for a three-month period. The least amount of hired labor found was two full-time employees plus 35 part-time workers for the three-week cotton harvest. Average hired labor utilized was 25 full-time workers, three-full-time semi-skilled workers, and 41 workers on a part-time basis of one to three months.

b. Alvarado Owner underemployment was not a problem since the amount of time dedicated to agriculture was largely a matter of

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[241]See p. 229.

individual preference. Nearly all resided in the city of Alvarado. Most of the cattle activities were carried out with hired labor, the owner making occasional visits to his holdings. No problems were encountered in securing sufficient hired labor.

Among the ejido-private group, greater owner-operator employment levels than in the ejido were provided by the cattle-raising which supplemented the cultivation activities. Little problem was encountered in securing hired labor.

Contrary to the regression results, the case study lends little support to Hypothesis 1.2 for the private sector. Only in instances where cultivation is attempted in isolated areas might labor shortages result in idle land. Low levels of labor utilization in the private sector were found to be associated with cattle-raising activities rather than idle land. Some support for Hypothesis 1.2 was found in the ejido sector--especially in Alvarado where labor shortage does appear to substantially influence land-clearing activities and therefore idle land.

Hypothesis 1.3: As the level of technology adopted increases, the amount of idle land will decrease:

1. Ejido sector

a. Apatzingán Only traditional crops of corn and sesame were grown in the ejidos interviewed. Average production on non-irrigated land was extremely low, typically, 600-700 kilos per hectare of corn and 500 kilos per hectare of sesame. Irrigation increased yields to approximately two tons per hectare for corn and sesame and allowed double cropping.

Use of non-traditional inputs varied widely with ejido. Nearly half the ejidos used only traditional inputs and consulted with no extension agents, salesmen, etc. In the remaining ejidos, some respondents had tried non-traditional inputs often with poor success, or insufficient credit to continue their use. Use of non-traditional inputs was limited almost entirely to fertilizer, with occasional use of insecticides. Adoption of modern input "packages" was definitely the exception.

Widespread dissatisfaction with the lack of technical assistance from the Ejido Bank was frequently voiced. As some stated: "The inspector only comes at the end of the harvest to inspect the crops". However, the influence of the Bank may be more subtle than they realized. It was apparent that many had learned about fertilizer use, new varieites, and contour plowing from the Ejido Bank, despite their claim of having received no technical advice. Furthermore, the Ejido Bank was able to encourage use of new inputs by payment in kind rather than cash[242]. Several who had accepted Ejido Bank credit were unimpressed with the results of the fertilizer, and it appeared the main reason for accepting the loan obligation was to secure cash for consumption expenditures.

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[242]Unfortunately, this practice can lead to inefficiency and corruption, resulting in price alteration, quality alteration, and poor timing in availability of the fertilizer and seeds provided. See, for example, Silos, José S. Instituciones de crédito agrícola del Valle del Yaqui. In Fernández y Fernández, Ramón, ed. Crédito Agrícola. Vol XII. Centro de Economía Agrícola. Escuela Nacional de Agricultura. Chapingo, México (pages unnumbered). 1968, and T. de la Peña, op. cit., p. 767.

As with crops, use of modern technology was infrequent in animal husbandry practices. Feed was limited to poor-quality native pasture and dry corn stalks. Occasional corn supplement was given in the dry season, but usually only to work animals. Although approximately two-thirds of those interviewed did vaccinate at least once a year against prevalent diseases, none utilized treatment for the serious tick problem. In fact, nearly all failed to even recognize the tick problem as being important. With only one exception, nothing was done for breed improvement except use of the most casual selection procedures[243].

Although infrequent, important instances of use of modern technology were found, which suggest the entrepreneurial potential is available for great improvement, if technology and credit were made more accessible to the _ejidatarios_[244]. _Ejido_ Bank success on some _ejidos_ in bringing about contour cultivation and fertilizer use suggests that the homogeneous nature of the _ejido_ can become an asset in transforming traditional practices if existing entrepreneurial talent is provided with credit and knowledge.

b. _Alvarado_ Crops grown by the Alvarado _ejidatarios_ consisted of corn, rice, sesame and beans. Although more diversified than in Apatzingán, the level of technology was even less advanced. All those

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[243] The single exception herded the "rich neighbor's fine bull" into his pastures during the night to "associate with his heifers".

[244] As an example, the individual who "borrowed" his neighbors' improved bulls also had secured fertilizers, insecticides, hybrid seed and crop insurance from the _Ejido_ Bank, and was planning to complete an irrigation system and develop a lime orchard. Unfortunately, termination of credit to the _ejido_ credit society of which he was a member brought a halt to all these activities.

interviewed used almost exclusively traditional inputs. One individual had applied insecticide and another had tried fertilizer on rice, but both had discontinued their use. Use of improved corn seed was mentioned, but this largely took the form of selected native varieties rather than acceptance of hybrid corn.

Closely related to the lack of modern input use was the lack of outside technical assistance. None had received any assistance from either the Ejido Bank or the agricultural extension service, and only one individual had consulted with salesmen.

Considering the lack of technical assistance, the level of awareness about modern inputs was greater than might be expected. The need to buy fertilizer and tools as well as to improve pastures and cattle was frequently mentioned; however, in no cases was knowledge found of green manure or contour-farming practices. The most frequently expressed credit need was for traditional land-clearing expenditures rather than for modern inputs.

Livestock technology used appeared to be considerably ahead of that used on crops. Some ejidatarios had actually planted improved pastures. Furthermore, a governmental program of tick eradication had received strong support from the ejidatarios.

On the less favorable side, only occasional selection was practiced as a means of breed improvement. Less than half had vaccinated their cattle against disease. Milk production was extremely low (two to three liters daily) and poorly handled. Despite the need for improved daily feed no grain supplement was used.

In Alvarado it also appeared that entrepreneurial potential was available to adopt production-increasing technology if information and credit were provided. The tick-eradication program's success and the planting of improved pastures were indications of willingness to undertake change. In two ejidos, the leaders pointed out the possibility of cultivating pineapple, avacado, mango, and coconut in the region (based on their observations of neighboring counties). Although they desired to introduce these crops into their ejidos, they realized the impossibility of initiating such activities without proper instruction and sufficient credit.

2. Private sector

a. Apatzingán Acceptance of new technology by the private sector formed a startling contrast to the ejido sector. As an indication, production levels could not even be compared for the two sectors due to the type of crops grown. Rather than the traditional crops of corn and sesame, the private sector was engaged in producing a great diversity of high-value, non-traditional crops. Nearly all land was planted in orchards or was double cropped--the usual case being cotton followed by watermelon or cantaloupe. Production diversity is demonstrated by the following crops, listed by decreasing acreage encountered: cotton, cantaloupe, limes, bananas, broom and grain sorghum, and watermelon. Lesser amounts were found of mangos, corn, sudan grass, sugar cane, rice, sesame and coconut. Not only was regional production greatly diversified, but individual enterprises were also diversified. The average number of crop activities per operator was three.

Besides the crop activities found among all individuals interviewed, about half also raised cattle. The average number of cattle owned was 80 head. Planned herd-improvement programs resulted in either purebred or improved crossbred stock being raised rather than the poorer native strains found in the ejidos. All operators fed balanced rations and had vaccination programs, usually making use of veterinary inspection services twice a year. Most followed a tick control program.

Use of modern inputs was also the rule in the cropping activities. Without exception all used fertilizers, insecticides, improved seeds and newly developed varieties. Less frequent use was made of soil-conditioners and herbicides. In all but two instances, outside consultation was frequently sought for advice on agricultural problems. Most relied on technicians hired by retail stores; however, some distrust was expressed about the motives and abilities of these technicians. Thus, rather than rely on the retail store recommendations, nearly one-quarter hired their own entomologists. County extension agents and grower association agronomists were also frequently consulted.

Machinery utilization was extensive. Among those who had tractors, the average number owned was three. All tractors were equipped with attachments for cultivation, fertilization, seeding, etc. Only two private operators did not own at least one medium-sized tractor. One rented all equipment needed and the other utilized 10 teams of animals. The largest operator had six medium-sized tractors, three tracklayers, four trucks and three pick-ups. Several individuals held part interest in airplanes for dusting.

All were familiar with contour farming. Those with hilly land usually had engineers survey and make the levels, but in some cases had acquired sufficient skill to do this on their own. Those with flatter lands had usually leveled their land in order to prevent erosion and facilitate irrigation. Several had incorporated various types of organic matter to improve their soils in the past. However, all now preferred use of commerical fertilizer rather than "losing" a crop to green manure.

In general, methods used by and the knowledge possessed by the private sector seemed to compare favorably with the most modern farmers practicing irrigated agriculture in the United States. One-quarter of those interviewed even kept daily records of their agricultural activities.

b. Alvarado In Alvarado, utilization of new technology was again much higher in the private sector than in the *ejido* sector. Although the majority of the livestock raisers fed only pasture (except for grain supplement to bulls and lactating cows). This pasture was of better quality than that found in the *ejidos* and in Apatzingán. Care was usually taken to adjust cattle numbers to the carrying capacity of the land. With high grain prices and little price incentive for quality meat, use of pasture with small amounts of grain supplement as practiced in Alvarado was probably the most profitable method of raising cattle.

It was clear that more attention was paid to breed improvement than had been previously found. All those interviewed purchased bulls from outside sources and practiced rigorous selection. Cattle vaccination and tick-eradication programs were common to all.

In addition to non-traditional inputs in cattle operations, new technology was extensively used on cultivated lands, and by those who were converting to permanent pasture. Nearly all those with native pastures had started or were planning to initiate pasture improvement programs. Varieties used were those suggested by the extension service for the region. Frequent individual experimentation was found in the use of new varieties and different herbicides. All applied commerical fertilizers to their corn and planted the recommended hybrid varieties. Herbicides were being tried in cultivated crops as well as in land-clearing activities. All made use of the technical assistance available in the area, having had at least occasional consultation with veterinarians, retail store agronomists, or experiment-station personnel.

Acceptance of new technology in the private-*ejido* groups was generally ahead of the *ejido* but behind the private sector. Although nearly three-quarters of the *ejido*-private members had at least some improved pasture, a higher proportion of their land was left in low-yielding native pastures than in the private sector, due to the common belief that flooding problems precluded conversion of their native pastures. Improved varieties developed for such conditions were more widely used in the private sector. Only 30 percent used grain supplement, and only half maintained a program of securing improved bulls from outside sources. In health care, nearly 80 percent had a regular vaccination program, compared with less than half of the ejidatarios[245].

Technology used in crop activities was also more advanced with both knowledge of new cultivation practices and amount of outside consulting exceeding that of the ejidatarios. Over 80 percent regularly used commercial fertilizers, hybrid seeds, or herbicides. Machinery was rented at times, a practice not found among ejidatarios. However, none were familiar with contour farming or use of green manure crops to reduce the prevalent erosion and fertility problems.

In summary, tests of Hypothesis 1.3 for the private sector are difficult, due to the consistently high levels of new technology used and low amounts of idle land encountered. The situation was similar with the ejido-private group. However, between sectors the dramatic difference in technology used is accompanied by the appropriate levels of idle land as suggested in Hypothesis 1.3. Especially important supportive evidence was found in Alvarado. Levels of technology adopted by ejidatarios were so low that little difference in idle land was expected to be revealed within the sector. This did not prove to be the case. Comparing all ejidatarios using any one of the new inputs of improved seed, fertilizer, insecticide, herbicide, or improved pastures with those using none, it was found that the former had only 19 percent

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[245] In view of the widespread adoption of health programs, it was surprising that only 45 percent consulted with veterinarians, suggesting animal health information was spread more by observation and word of mouth than by the direct consultation found in the private sector.

of their holdings idle, whereas the latter had 50 percent idle[246]. Overall, case-study findings lend support to Hypothesis 1.3.

Hypothesis 1.4: The greater the amount of fragmentation and inaccessibility of holdings, the more likely such holdings will be left idle:

1. Ejido sector

a. Apatzingán For the Apatzingán ejidatario, location of farm land was yet another factor working to his detriment. The amount of time required for a round trip between place of residence and the furthest holding was used to indicate accessibility problems. The average for all ejidatarios interviewed was one and one-half hours travel time. Even for the closest holdings, average time required was nearly one hour. The problem is compounded by non-contiguous or fragmented holdings. The average number of holdings per ejidatario was 2.2 (excluding the communal lands)[247].

Although distance of holdings appeared to be an important cause of idle land in some cases, the relationship was obscured by small holdings often being forced into cultivation by the lack of additional closer holdings.

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[246] This occurred despite the fact that the size of holding was larger among the adopters (8.7 hectares) than among the non-adopters (6.7 hectares).

[247] The extreme case found was that of one ejidatario who managed four parcels of land, each parcel in a different direction from his place of residence. Two were at two hours distance, one a one-half hour's distance, and the fourth was five minutes away.

The importance of distance becomes apparent when it is recognized that ejidatarios in this region rely entirely on animal power for working their lands. Because of poor animal nutrition, it has been estimated that the effective working period of the oxen or mules is from four to six hours[248]. Hence, with one to four-hour trips to arrive at the fields and return, the remaining work capability of such an animal is indeed low.

b. Alvarado In Alvarado, a modified form of slash-and-burn agriculture was followed, the practice being carried out on small holdings in one location rather than being migratory in nature. However, location of land holdings relative to residences did not appear to be a serious problem, since land tended to be in single blocks, and there was a greater tendency to live near holdings rather than in vilages. Extension agents in the region had mentioned the problem of work-animal energy expended in reaching fields, but it did not appear to be a cause of idle land among those sampled in Alvarado.

2. Private sector

a. Apatzingan With only one exception, all fields in the private sector were within one-half hour's distance[248a]. Shortened travel time

[248]Villanueva Barradas, Juan. Personal communication. 8/28/68.

[248a]In the one exception, the operator's closest field was an hour away and his farthest field two and one-half hours distant in a neighboring state. However, he was in the process of changing his residence to facilitate bringing under cultivation those lands which were idle and uncleared.

resulted from all operators owning pick-ups. Thus, inaccessibility was not a factor causing idle land.

b. Alvarado  Many private owners had their holdings divided into two blocks of land located some distance apart. This was to allow seasonal movement of cattle from low to high lands during periods in which the lowlands were flooded, and was not a cause of idle land. Cultivated cropland location was similar to that of Apatzingán and no idle land resulted from this factor.

The Alvarado *ejido*-private group usually had their private lands located from one hour to one day away from their *ejido* holdings. In all cases, the private lands were used exclusively for pasture. Surprisingly, although the holdings were far apart, the distance factor did not constitute a problem to land use. In fact, despite the additional distant cattle operations, less cultivated cropland was left idle by this group than by the *ejidatarios*.

Reviewing the findings, where problems of fragmentation and access to landholdings were found, Hypothesis 1.4 was supported as an important if not decisive explanation for idle land[249].

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[249] The influence of distance from holdings appeared especially important in explaining the incidence of uncleared land. Where distant lands are part of an idle-land rotation scheme to regain soil fertility, greater problems in controlling vegetative growth could cause these lands to be cultivated less frequently than closer lands. In view of the great deal of underemployment encountered, it is somewhat surprising that the "free time" was seldom used to clear the more distant lands.

Hypothesis 1.5: Holdings characterized by uncertainty of title are more likely to be left idle than those with clear titles:

1. Ejido sector

a. Apatzingán The hypothesized relationship between idle land and unclear land title was based largely on the supposition that credit limitations would result. The incidence of unclear titles in the Apatzingán *ejidos* was most disquieting. Over one-half of those interviewed had their land in "provisional" form only, i.e., with no written documents whatsoever.

A direct relationship between idle land and title uncertainty was found. All *ejidatarios* with substantial amounts of idle land also lacked clear land titles. Surprisingly, the relation between idle land and title uncertainty was found to prevail even independently of credit availability. The somewhat rare occurrence was found in this region wherein the *Ejido* Bank was loaning to *ejidatarios* without clear titles. Even with the available credit, the *ejido* members continued to leave large amounts of land idle. Although the credit provided was considered inadequate by recipients, it appears that unwillingness to cultivate and clear land without proper title also influences the idling of land resources[250].

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[250] With surprising candor, one individual admitted he was unwilling to improve one of his holdings until clear title was secured, since he was afraid it would be subsequently allocated to the *Ejido* President's friends and relations.

b. Alvarado Similarity in the problems of the *ejidatario* of Apatzingán and Alvarado continued to be discovered in the land title situation. Approximately 80 percent of those interviewed had land holdings in a provisional form only. This circumstance aggravated the idle land problem even more than in Apatzingán, since the percentage of unclear titles was considerably higher and since no instances were found where credit had been extended under conditions of unclear title.

2. Private sector

a. Apatzingán Title uncertainty was also a problem for the private sector in Apatzingán. Only half of those interviewed had clear title to all they "owned". For the rest, at least some portions were still "being processed". Cattlemen had even greater land-holding uncertainty problems, since previously granted "*certificados de inafectabilidad*", exempting large natural ranges from expropriation for the purpose of cattle raising, were no longer being renewed[251]. With the widespread uncertainty of land ownership, it is possible that some bias due to fear of having lands invaded is built into the responses. If so, the title-uncertainty situation would be even worse than indicated above.

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[251] *Concesiones de inafectabilidad ganadera* were special concessions for livestock raising wherein landholdings were allowed to exceed the limit otherwise established for expropriation. The concessions were granted for a 25-year period by presidential decree, with a maximum limitation of 50,000 hectares. Without such a concession, the allowable landholding is that necessary to sustain 500 head of cattle. See Leyes. Código Agrario. Art. 115, and 117 and Reglamento de inafectabilidad agrícola y ganadera. Art. 9, *op. cit.*, p. 45, 48 and 217.

It is apparent that credit availability is closely related to clear land ownership. In all cases, those of the private sector desiring more credit were either renters or were holders of unclear title. Their sources of credit were limited to commerical stores or individuals (often family members). Owners of clear land titles expressed no credit problems, several being completely self-sufficient in credit needs.

b. Alvarado The Alvarado private sector did not have the problems of uncertain land title. Without exception, all individuals interviewed had clear land titles, and were not relying on "certificados de inafectabilidad" when planning their future operations. As indicated in Hypothesis 1.1, sufficient credit was available to those willing to mortgage their land. There was also less reason to conceal any unclear land titles since the land-invasion problems of Apatzingán were not encountered. Absence of land-invasion problems together with clear land titles could help explain the more progressive attitudes of Alvarado cattlemen, and their willingness to plant permanent pasture, a practice not found in Apatzingán.

In the area of land titles as in no other area, the characteristics of both the ejido and private sector were embodied in the ejido-private group. As in the private sector, all had clear title to their private lands. As in the ejido sector, all but one held their ejido lands in provisional form only. Supplementary private holdings with clear land title allowed this group to secure credit, which was not available to the ejidatario, for utilizing idle land.

In summary, strong support was found for Hypothesis 1.5 in all areas tested. Idle land was found to be closely related to unclear land titles in the *ejido*, private, and *ejido*-private sectors. Independently of credit availability, instances were encountered of an unwillingness to apply credit to land improvement investments where title was uncertain.

*Hypothesis 2.1: Areas of greater irrigation development will tend to have less idle land:*

1. *Ejido sector*

a. *Apatzingán* In an area where availability of irrigated land is critical, many *ejido* settlements had to rely entirely on seasonal, dry farming activities. Lack of sufficient irrigation was always mentioned as a major agricultural problem, even in those areas where some irrigated lands had already been developed. In no instances were the irrigated lands left idle, thus supporting the argument that such land would be cultivated due to the high opportunity-cost of leaving it idle.

b. *Alvarado* No irrigation was found in Alvarado, although frequent mention was made of its need. Lack of irrigation might have contributed to idle land, but seemed a less important factor than in Apatzingán because of the higher rainfall, and the more valuable crops already being cultivated.

2. *Private sector*

a. *Apatzingán* Only one instance was found where a large amount of irrigable land was left idle[252]. *Ejido* interviews indicated that irrigated land was not left idle. There is no reason to expect this would be less true for the private sector, since the opportunity cost of leaving the irrigated land idle would have been extremely great, considering the high yields of valuable crops common to the area and the ready supply of land renters.

b. *Alvarado* In Alvarado, no irrigated land was found in the private sector; however, this lack of irrigation did not appear to result in idle land (since no idle land was found).

Support is thus found for Hypothesis 1.2 in the case studies. The greater the proportion of cultivable land which is irrigated, the lower the proportion of idle land, due to the high opportunity cost of leaving irrigated land idle.

*Hypothesis 2.2: Areas of heavier ejido concentration will tend to have higher amounts of idle land:*

When trying to determine the influence of land tenure, it is often difficult to distinguish between those aspects directly attributable to the land-tenure system and those which are only secondarily associated with it. For example, credit availability is directly attributable to the land-tenure system since the mortgaging restriction on the *ejido*

[252]This individual was an ex-*ejidatario* who had purchased 50 hectares of land from a government bank 12 years ago with his *bracero* earnings. Allegedly due to insufficient pumping capacity, 20 hectares were left idle. However, because of inability to secure clear title, the individual had been unable to secure credit to even dry-farm the idle portion. The problem was aggravated by neighboring *ejidatarios* trying to take over his land. The finding lends support to Hypothesis 1.1: that is, with limited credit, increasing returns to capital may be (footnote continued on following page)

precludes credit from private sources. On the other hand, important differences were found to exist between the two land-tenure classes in such areas as educational levels, attitudes towards education, attitudes about idle land, etc. which do not appear to be per se a direct result of the particular tenure system. Thus, Hypothesis 2.2 is to some extent a "catch all" hypothesis which considers all residual differences between the two tenure classes which might influence idle land and which have not been separately enumerated for consideration in the other hypotheses.

1. Ejido sector

a. Apatzingán   Although considerable variation was found among ejido settlements, one characteristic common to all was the smallness of holdings. In Apatzingán, the average holding consisted of nine hectares of seasonal land, two hectares of irrigated land, one and one-half hectares of native pasture, and unspecified amounts of largely unproductive communal pasture land. No land was found to be rented between ejidatarios, although several expressed desire to rent land from others.

The average size of holding enumerated above includes land held in the name of sons, cousins, etc. but managed by a single operator. Influential persons were able to take advantage of their position to obtain such aggregate holdings. In one case, the Ejido President held fields in the name of his 10, 12, and 14 year old sons! Even so, the largest "aggregate" holding was only 20 hectares of seasonal and five hectares of irrigated land.

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(footnote continued from previous page) experienced so that cultivation activities are concentrated on a portion of the land, the remainder being left idle.

The incidence of idle land found in the sample was less than might have been expected according to the census. Although most ejidatarios had little or no idle land, a few had substantial amounts, resulting in an average of over two hectares idle per ejidatario. This represents 23 percent of the average cultivable area per ejido.

It appears that idle land in the ejido sector is greatly influenced by the size of holding. Defining two hectares of seasonal land as the equivalent of one of irrigated land, virtually no idle land was found among holdings under 16 hectares of such "seasonal land equivalents". By contrast, for holdings over 16 hectares approximately 20 percent was idle, a figure which increased to over 30 percent for holdings above 24 hectares.

Of those indicating an ability to expand their size of operation, on the average, only five hectares could be added before other resources became limiting. In all cases the constraining resources were either work-animals or hired labor. From these responses, it is seen that although expansion is limited in many cases by unavailability of land, with rather small increases of land other resources rapidly become limiting and would probably result in land being left idle.

Although idle land was not encountered as frequently as expected, a revealing discovery made was the widespread favorable attitude towards the practice of leaving land idle. In part, acceptance of the practice was based on the belief (held by all ejidatarios interviewed) that idle land was an important means of increasing soil fertility[253]. However,

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[253]Besides belief in soil fertility benefits, other vague or folklore type answers showed idling of land (footnote continued on following page)

the slight fertility increases which might have accompanied idle land through growth of native clovers and weeds were largely fortuitous.

As a result of these beliefs, those leaving no land idle did so because all available land resources were required for their subsistence, not because they questioned the advisability of leaving it idle. In fact, some expressed the desire to have more land so they could leave some idle!

The startling conclusion reached is that land would be left idle much more frequently in this region were it not for many extremely small holdings. If these results are found to have widespread applicability, the policy implications are important. The findings suggest that increasing the size of holding per ejidatario, even to the legal minimum, would result in only limited production increases unless attitudes about idle land were also changed.

Education could alter attitudes towards non-traditional cultivation practices; it could increase the self-confidence required to seek information from extension agents, salesmen, etc., as well as facilitate understanding of the explanations rendered. Increased education could result in awareness of new technology, either by direct exposure or indirectly by providing the ability to read about innovations and new practices. These considerations prompted an examination of the attitudes

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(footnote continued from preceding page) was considered desirable. For example, it was thought that idle land helped the soil "keep its heat", allowed the ground to rest "just like people need rest", etc.

towards, and levels of, education in order to identify any differences between land-tenure classes which might help explain the contrasting levels of idle land.

With the exception of one _ejidatario_ who had undertaken special agricultural capacitation courses at the agricultural training center in Apatzingán, educational experience was extremely low. The average for the remaining respondents was completion of less than one year of schooling, with three years of schooling being the highest educational level attained. Two-thirds had not completed even one year of schooling, with over half of these completely unable to read and write.

Aspirations regarding educational levels desired for their children were especially distressing. Less than one-quarter desired their children to continue past primary school[254]. Most children were receiving three to five years of education, but some were receiving none (although there were schools in every one of the _ejidos_)[255]. Although education was recognized as important, it was ranked well below roads, electricity, drinking water, and irrigation as an expressed need.

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[254]Notions about educational levels required for occupations were completely unrealistic. One wanted his children to attend school for six or seven years so they would be able to become doctors and teachers! Another individual felt he had suffered for having been taken out of school the first year. He was going to make sure his children got three years of education so they would not have to suffer as he had.

[255]In one settlement, the teacher had been recently assassinated by members of a neighboring feuding group, and possibilities for renewing any educational activities in the near future were remote.

b. Alvarado In Alvarado, as in Apatzingán, the amount of land owned was small, with average holdings slightly under seven and one-half hectares of unirrigated land--even less than in Apatzingán. Size of holding was more uniform, however, the largest reaching only 12 hectares. No renting of ejido land was found.

Examination of the idle-land situation in Alvarado revealed important differences from the Apatzingán case. Rather than a few larger holdings accounting for most of the idle land, the practice was more evenly distributed among all those interviewed. Handling of these lands was also different. In nearly all cases, the idle land was incorporated into a definite rotation pattern. The most common scheme was to cultivate a different one-third to one-half of the holding each year, leaving the remainder idle[256].

The findings for the ejido sector of Alvarado reinforce census indications that idle land exists. In fact, the proportion of idle land found among those interviewed (45 percent) was considerably higher than census reports (27 percent).

Despite the smaller holdings the size of holding was still noticeable as a factor influencing idle land. Fifty percent of the holdings over five hectares were idle, compared to 40 percent among those owning less than five hectares.

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[256]As was the case for Apatzingán, "idle" land was often used for pasturing work animals. However, a number also had land in natural pasture or used communal pasture, making grazing of idle land convenient, but not necessary in terms of feed available elsewhere.

Some dissimilarity was found between the two regions in their ability to cultivate increased amounts of land. In Alvarado, only 20 percent of the *ejidatarios* indicated they could cultivate more land. Among this 20 percent, only three to four-hectare increases were possible. With even less ability to expand cultivation in Alvarado, to bring landholdings up to the minimum legal size probably would result again in idle land rather than increased production.

Attitudes towards idle-land practices were similar to those found among the Apatzingán *ejidatarios*. The opinion was unanimously held that idle land was important and desirable as a practice to increase soil fertility. Again the practice was not followed to increase water retention, lessen soil erosion, etc.

The isolated nature of the Alvarado *ejido* settlements appeared to influence idle land more than in Apatzingán. Many *ejidos* were cut off from principal markets by lack of roads and bridges. Most of the year, transportation was possible only by a combination of horse and boat. A single dirt road allowed trucks to enter for produce by an expensive, roundabout route, but this road was open only for short periods. Even the dilapidated bus transportation of Apatzingán was unavailable. This lack of transportation resulted in low on-farm prices (despite government price-support programs), which greatly decreased the opportunity cost of leaving land idle.

As in Apatzingán, educational experience among the *ejidatarios* of Alvarado was dramatically deficient; but only one respondent could neither read nor write. Excluding one exceptional case[257], the average respondent had completed less than one and one-half years of schooling, and desired his children to complete three and one-half years. None felt his children needed more than a grammar school education, and none mentioned lack of education as an important problem in the area.

2. Private sector

a. Apatzingán Conditions in the private sector of Apatzingán were quite unlike those of the ejido sector. The average holding consisted of 99 hectares of irrigated land, of which 33 hectares were rented. As high as this average is relative to the ejido's, it would be even greater if the sample were limited to full-time farmers.

The land-rental situation encountered in Apatzingán is of particular interest, since nearly all rented land belonged to ejidos. Although the practice was illegal, it was apparently widespread. According to those who rented these lands, it was possible to "fix up" agreements through governmental officials in charge of ejido affairs, so that rentals were "legal". It was claimed that if renting resulted in "improving the ejido lands", such private rentals were allowable. Thus, through the normal practices of adding fertilizers, herbicides, and insecticides, the land was "improved for the ejidatario[258]. The only complaint heard from the

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[257] This individual had completed one year of high school, and felt his children should at least finish high school. No others interviewed had completed more than three years of schooling.

[258] In one case encountered, the private renter gathered together 14 ejidatarios, each of whom owned 10 hectares of high quality, irrigated land, and whose holdings were all contiguous. In this way, he was able to rent a single block of 140 hectares of irrigated land for cotton.

renters was that the ejidatarios often spent the money and then wanted the land back or more money. However, since this was all arranged with the authorities, it posed no great problem to the renters.

The ejidatarios who rented their land worked as hired laborers for the renters or other private operators, or simply "retired". According to those who rented the lands, the ejidatarios allowed their land to be rented because they lacked the necessary preparation and knowledge, or lacked the desire to farm intensively.

It is unknown how widely practiced throughout Mexico such illegal renting is, however, one continually hears reports which suggest it is of common occurrence. Even so, it was surprising that much of the best land developed for the ejido in this region was actually being farmed by the private sector, while ejidatarios on poor isolated land continued farming their lands under subsistence conditions.

Nearly half expressed satisfaction with the present level of operations in the private sector. Non-farm obligations often precluded further expansion. For the remaining half, the average possible increase in size was 100 hectares. Further expansion was limited by time and credit.

The idle land findings for the private holdings were completely unanticipated. Based on census data and the results of the ejido sector, substantial amounts of idle land were expected. Yet in only two cases were sizeable proportions of idle land encountered[259]. Even with its

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[259] These two cases are described further in the footnotes 248a (p. 210) and 252 (p. 216).

large holdings, the private sector's capacity to cultivate land without leaving any idle was such that the relationship between idle land-size of holding noted in the ejido was not encountered.

The private sectors' attitude towards the practice of idling land was completely opposite to that of the ejidatarios. Instead of considering it desirable and beneficial, idle land was viewed as a sign of ignorance, laziness, or failure. Some thought that small fertility increases might be achieved by leaving land idle, but most did not. All felt that chemical fertilizer should be used instead of leaving land idle. A few recognized the possibility of water-retention gains, but none practiced it even for this reason, nor did they feel this was a motive for idle land in the region. Several went so far as to point out that deleterious rather than beneficial effects could result from leaving land idle, noting the possible buildup of weed and insect problems. All preferred cultivation and fertilization to any type of idle-land practice.

High educational attainment levels were common in the private sector. Only one had not attended school, and one other had completed only three years of schooling. All others had completed more than six years of school and all were literate. As one result of this higher educational level, the attitudes towards education for their children were also quite different. Without exception, all individuals anticipated careers for their children which would require education beyond the high school level.

The earlier suggestion that higher levels of education and more favorable attitudes toward the value of education could be accompanied by alterations in beliefs and values, which could influence attitudes towards traditional practices (such as idling of land), was consistent with the contrasting findings for the ejido and private sectors in Apatzingán.

b. Alvarado Those interviewed in the private sector of Alvarado were primarily concerned with cattle raising. Cultivation was usually conducted only in anticipation of pasture development. Lands were planted to corn or watermelons for one or two years after land-clearing operations, the returns from which more than covered land-clearing and pasture-development costs. One exception was an individual who planted 60 hectares of yucca in addition to his cattle operations.

The size of holding in the private sector was quite variable, ranging from 67 to 1048 hectares, with the average holding being over 450 hectares. Determination of size of holding was complicated by the widespread practice of placing land in the names of family members. Thus, size of holding reported above is probably biased downward from the actual situation.

The census reported only 5,633 hectares, or 11 percent of the private sector's land as being cultivable. However, only 1,957 hectares, or 3.8 percent of the total land, was actually cultivated. Difficulty in finding cultivated land among those interviewed closely parallels the low amount reported in the census.

Interview findings and census reports for land use diverged conspicuously in the case of idle land. Although some 65 percent of the cultivable land is idle according to the census, no land which could properly be classified as idle was found among the respondents.

Surprisingly, the level of formal education was quite low. Not one of the private operators had progressed beyond primary school, with average education completed being only three years. This finding was unexpected, especially in light of the new technology and modern farming practices adopted. However, the private farmers appreciated the value of education more than the *ejidatarios*, as seen in the desire for a high school education for their children.

Thus, to the extent favorable attitudes towards education may be more important than actual levels of education as indicators of a propensity to accept change, these findings are consistent with those of Apatzingán, where similar contrasts in attitudes towards idle land and education were found for the two land-tenure categories.

In the *ejido*-private group, the average *ejido* holding of 14 hectares was twice that of the "pure" *ejidatarios*. Added to this were their private holdings which averaged 51 hectares. Cultivated crops consisted of corn, rice, and a small amount of sugar cane. The cultivable land was similar in quality to the *ejido* sector's idle lands and was rotated with the cultivated portion. The important difference between the two groups was that 45 percent of the *ejidatarios'* land was idle, whereas in the *ejido*-private group, only 17 percent of the *ejido* lands were idle.

In contrast to the *ejido* and private sectors where there was a general satisfaction with present amounts of land held, responses from nearly three-quarters of the ejido-private group indicated the desire to increase their cultivated acreage. However, in all cases, they would be able to do so only if the increase in land were accompanied by greater amounts of credit.

Hypothesis 2.3: Areas of greater off-farm employment alternatives are characterized by larger amounts of idle land:

1. Ejido sector

a. Apatzingán With only one exception, small village stores provided the only form of supplementary off-farm employment found in the Apatzingán ejidos[260]. Nearly one-third of the respondents had participated in the "Bracero Program" at some time, and many voiced the desire to participate were the program to be renewed. Several expressed a nearly desperate desire to leave the ejido, and were willing to leave their interests in the land behind if any alternative employment could be assured, thus supporting Hypothesis 2.3 in suggesting higher levels of idle land would have resulted.

b. Alvarado In Alvarado, employment alternatives were in fact available to the ejidatario. Many participated in fishing activities full-time or part-time. In fact whole ejido settlements were found where farming was only a secondary occupation. Lands were left idle or

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[260]The only other source of employment found was that of a former student of the agricultural technical school in Apatzingán. Besides farming his father's ejido land, he was employed as a manager of a large farm in Apatzingán.

extensively pastured and the ejido had actually become a "fishing ejido". Credit which had not been available for their farming activities had been secured to purchase nets, motors, boats, etc.

Besides the direct impact indicated above, off-farm employment indirectly influenced levels of idle land by contributing to the labor-shortage problems experienced in cultivation and land-clearing activities[261].

2. Private sector

a. Apatzingán Over half of the private operators interviewed held off-farm jobs. The following types of off-farm employment were found: ownership of a vulcanizing shop, equipment-repair shop, broom factory, cheese factory, drugstore, and bus transportation line; managers of cotton gins, fruit, vegetable, and grain marketing cooperatives; regional governmental veterinary inspector, etc. The average scale of operations and farm income would increase considerably if these part-time farmers were excluded.

The incidence of bracero experience found in the private sector was approximately half that of the ejido sector. The effect of this experience on farming operations was much greater, however[262]. This agrees

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[261]See p. 198.

[262]The former braceros stated that nearly everything they knew about commercial agriculture had been learned while in the United States--fertilizer use, irrigation and cultivation practices, tractor driving and equipment repair. In one case, bracero earnings enabled the individual to leave the ejido and become a private landowner.

with what a number of ejidatarios had earlier stated--that in the ejido situation there was little opportunity to utilize knowledge acquired during the bracero experience, since much of their land was not irrigated and since there was such a shortage of credit.

b. Alvarado  Non-agricultural pursuits dominated agricultural employment for several individuals with smaller private holdings. As in Apatzingán, such employment was not associated with idle land.

Summarizing, strong support was found for Hypothesis 2.3 in the ejido. Apatzingán ejidatarios had previously left large amounts of land idle during their participation in the bracero program. A strong willingness was expressed to participate in the bracero program or any other type of work available. In Alvarado, such alternative employment was at hand, and the result was substantial numbers leaving their lands idle.

For the private sector, off-farm employment was not associated with idle land. The difference in the effects of off-farm employment on idle land found for the ejido and private sectors suggests Hypothesis 2.3 applies to unskilled, traditional farmers of low agricultural productivity rather than to commercial farmers.

It should be emphasized that only those cultivating their land but willing to leave it idle in trade for off-farm employment were contacted. If those who had actually left their lands idle in accepting other employment could have been identified, support of Hypothesis 2.3 would have been even stronger.

Hypothesis 3.3: Greater amounts of idle land will be encountered when land holdings are of poorer quality:

1. Ejido sector

a. Apatzingán The smallness of land holdings in the Apatzingán ejido becomes in effect even smaller when the quality is compared to the private sector. Lack of clear title and irrigation development, isolation, and fragmentation of holding have been considered in foregoing hypotheses. Other factors also adversely effect the quality of the Apatzingán ejido lands. Soil erosion due to rainfall was considered a serious problem by 45 percent. Nearly one hectare per ejidatario was lost to production because of eroded canals. Incidence of rocky and hilly land added to the problem. Soil-infertility problems were considered important by over 60 percent of those interviewed, and the desire to restore this fertility constituted a principal motivation for leaving, or desiring to leave, land idle.

The high incidence of ejido crop losses are also indicative of the poorer quality of holdings. Crops completely lost to harvest averaged nearly one and one-half hectares per ejidatario, which represents nearly 15 percent of the cropland. These losses were due principally to drought and soil erosion, with lesser amounts attributable to wind damage. These same factors reduced yields considerably in the areas harvested.

The heavy ejido population pressures on available land resources in Apatzingán are now seen to be even more severe than previously indicated. Of the original average holding of nine hectares of seasonal and two hectares irrigated land for each ejidatario, nearly four and one-half hectares are non-productive due to idle land, soil erosion, and complete crop loss.

b. Alvarado    In Alvarado the principal problem was excess water. All those interviewed mentioned soil erosion due to heavy rains as an important problem. In the dry season, drought prevented double cropping, but overall the benefits from higher moisture appeared to offset the smaller holdings in Alvarado compared to Apatzingán. Higher-valued crops could be cultivated and substantially lower crop losses were reported. Only three percent of the cultivated area was completely lost to harvest, compared to 15 percent in Apatzingán. Among Alvarado ejidatarios the idle-land practice was again the accepted means of restoring soil fertility.

To sum up, support of Hypothesis 3.3 was provided by both ejidos studied. Not only is the quality of the ejido holdings below that of the private sector, but the idle-land practice comes as a direct outgrowth of the desire to improve soil fertility.

2. Private sector

a. Apatzingán    In nearly every case, the quality of private holdings was excellent, or the owners possessed the necessary knowledge to adapt to the soil conditions. Where land was hilly, it had been leveled or contour farmed. Where natural fertility was low, commercial fertilizers were added. The result was negligible crop losses due to soil erosion and soil fertility problems.

b. Alvarado As in Apatzingán, the private sector overcame its low soil fertility problems by use of commercial fertilizers rather than idle land. Also, in those areas of lower productivity, cattle operations were carried out rather than attempting to pursue marginal cultivation activities.

Thus, for the private sector in both areas, adaptation to land quality problems was made by using fertilizers, leveling, or substituting non-cultivation activities rather than pursuing the cultivation--idle land practices of the *ejidatarios*.

Hypothesis 3.4: Systematic biases in census reporting can be detected which explain idle-land levels reported:

1. Ejido sector--Apatzingán and Alvarado

In the two areas, an ambiguous situation was found in terms of what operators considered idle land. In some cases an idle land-cultivation rotation scheme was followed, whereby animals were allowed to pasture weed growth. Such fields were considered idle by some, but not by others. Thus, a portion of the *ejido* idle land does not meet the strict census definition, but is essentially idle except for limiting grazing. In fact, in Alvarado, idle lands were difficult to distinguish from native pastures. Although more idle land was found in Alvarado and less in Apatzingán then reported in the census for the *ejidos*, the amounts encountered were similar enough to support the census in substance.

2. Private sector

a. Apatzingán Interview findings of extremely low amounts of idle land in the private sector of Apatzingan contradict the census reports. Three possibilities are suggested as explanations for this lack of agreement. First, the region could have undergone great change since the time the census was taken. Second, the interviewed sample may have been unrepresentative of the private sector. Third, census reporting may have been inaccurate. As seen in the discussion which follows, there are indications of an element of truth in each of these three possibilities.

1) Intertemporal regional change A complete evaluation of the changes in regional characteristics between the 1960 census and the time of interview will not be possible until the 1970 census results are published. Unfortunately, if past experience is any indication, these results will not become available until 1977. Even then, any valid comparison would depend on the census accuracy.

It is apparent that the region is in the process of rapid change. Many individuals of the random sample used by the Centro de Investigaciones Agrarias approximately two years earlier could not be found due to the high incidence of out-migration. None of the owners with holdings under five hectares could be reached.

Differences in production patterns also indicate changes since the 1960 census. Harvested irrigated area was reported as slightly over 1,000 hectares in the census. Yet twice this amount was found in the interview sample alone. In fact, a single farmer, visited informally, had more harvested irrigated land than the total amount reported for the census for the whole region.

The amount of land receiving fertilizer was reported as slightly over 1,500 hectares. Again this amount was surpassed in the sample alone. In the census category of production of "other crops" (which covers nearly all crops important to the area except corn, sesame, and fruits), only 747 hectares appear. This much harvested acreage was found simply for cotton in the sample, without including sizeable acreages of cantaloupe, grain and broom sorghum, watermelon, etc.

If the census figures are accurate, a great upheaval had occurred in Apatzingân. It is possible that during the period of census enumeration, ownership turnover and agricultural change were so rapid that large amounts of idle land resulted. More likely, during the intervening period practices could have changed from predominately seasonal, traditional cultivated agriculture (which included idle land practices), or from livestock activities to irrigated, commercial agriculture.

The present study was unable to evaluate the extent to which idle land might have been a result of transition from seasonal to irrigated production. However, to the extent that idle land might have been due to a transition from cattle grazing to irrigated production, an evaluation could be made since the process was still occurring[263].

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[263] See pp. 237-238.

2) Unrepresentativeness of the sample There are a number of indications that the interviewed sample is not representative of the private sector. The amount of off-farm employment and the salary level of this employment seem exceptionally high. Although the region had been historically important in livestock production and livestock continued to be raised, no exclusively livestock operations were found among those farmers originally interviewed. The sample was comprised almost entirely of irrigated land. Since irrigated land was not left idle in the *ejido*, there was little reason to anticipate idling of these lands in the private sector. By underrepresenting seasonal lands and livestock activities, the sample may have missed those of the private sector most likely to have had idle land.

3) Census-reporting inaccuracies Considerable evidence was accumulated which casts doubt on the census reliability for the private sector in Apatzingán. Only 18 hectares of cultivable land were reportedly double cropped by the private sector, whereas 249 hectares were reported for the *ejido*[264]. Nearly 6,000 hectares were reported to be susceptible to cultivation for the *ejidos*, but only 116 hectares for the private sector[265]. Only 19 trucks were reportedly owned by the private sector, yet 36 were reported among the *ejidatarios*[266]. In all

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[264] Secretaría de Industria y Comercio. Cuarto Censos Agrícola. Resúmenes estatales. *op. cit.*, Estado de Michoacán. Table 5.

[265] *Ibid.* Table 5.

[266] *Ibid.* Table 4.

the above instances, although estimates for the ejido sector appear accurate, private sector reports seem grossly underestimated. Most damaging of all, the census reported only 17,000 hectares of irrigated land in the Tierra Caliente region, whereas the Secretaría de Recursos Hidráulicos, (the office in charge of the irrigation districts) reported nearly 71,000 hectares irrigated for the same year[267].

To pursue further the idle-land question in the private sector, additional visits to the region were made in which a less structured interview format was utilized. To overcome some of the deficiencies of the sample, emphasis was placed on including non-irrigated lands, especially those of livestock producers. Cooperation of the census office was secured in compiling a list of residents for whom substantial amounts of idle land had been reported in the census (often 100 percent of their holdings).

The list of names provided by the census office again had the disadvantage that many had migrated out of the region. Interestingly, all those remaining had one feature in common: they raised livestock exclusively. Thus, an opportunity was afforded to study the possible reasons for idle land in the livestock sector, and to see how the transition from livestock operations to irrigated crops might have influenced the incidence of idle land.

The livestock sector of the region exhibited characteristics quite different from those encountered in the irrigated agricultural sector.

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[267] Barkin. op. cit., p. 25.

Livestock raisers were members of older established families whose lands had been inherited rather than purchased. Extremely large tracts of land were still held by this group. These lands were often capable of development and even irrigation, but were being left in native brush "pasture" of extremely low carrying-capacity.

The lack of development in this sector can probably be attributed to institutional restraints imposed. The limitations on maximum legal size of holding decrease the incentive to develop the native brush lands. The maximum landholding which is protected from expropriation is that sufficient to sustain 500 head of cattle. As carrying-capacity is increased through land development, the size of holding exempt from expropriation decreases. Therefore land development would actually be punished, since thousands of hectares would become liable to expropriation.

Visiting with the cattlemen, it soon became apparent that much of the land reported in the census as idle land had been misclassified. Census reports to the contrary, this land had never been cleared or cultivated. In fact, the owners were afraid to cultivate it! It is understandable that the cattlemen might be reticent to admit to the census enumerator that their lands were susceptible to cultivation, due to fear of expropriation. Since the native grazing lands were often adjacent to land which was being cultivated it is easy to see why a census enumerator might have incorrectly considered the native pastures as idle lands.

The above argument seems to give the census enumerator too much benefit of the doubt. It appears he had not even conducted the interviews as required by law. The nearly unanimous response of those interviewed from the list provided by the census office was that they had never been contacted by a census enumerator.

The conclusion that the enumerator did not conduct the interviews is further reinforced by an examination of the census ballots for these individuals. The ballots were only partially completed, often no information being provided beyond the land utilization questions (wherein thousands of hectares of land were considered idle). Only about 40 of the 314 questions were completed. It is suspected that the enumerator took the names and addresses of the registered holdings and simply considered them idle.

It should be mentioned parenthetically that the census collection period coincides with the rainy season of Apatzingán, at which time large surrounding areas are virtually inaccessible. This may account in part for the way in which the census seems to have been conducted.

The difference in the apparent reliability of the _ejido_ and private sector reporting may be due to the different method by which information for each is collected. The _ejido_ president collects information in each _ejido_ settlement. He is familiar with the _ejido_ and what the members are doing. In the case of the private sector, an enumerator is hired who may have poor knowledge of the area and little confidence of the people.

b. _Alvarado_ As in Apatzingán, census reports of high amounts of idle land in the private sector are contradicted by the interview findings. The same three possible sources of discrepancy analyzed in the

Apatzingán case are again considered.

1) Intertemporal regional change In contrast to Apatzingán, the region has not undergone such rapid transition that present conditions differ markedly from those found at the time of census enumeration. Even the conversion to permanent pastures is still in its initial phase and it is doubtful that anticipation of such change at the time of the census could have been the cause for classifying land as idle.

2) Unrepresentativeness of the sample Failure to find idle land in the private sector could have been due to the way in which the sample was selected. Use of growers' lists and random selection of residences visible from roadside may have biased the sample. However, other than the idle land factor, sample characteristics generally parallel census indications of what a representative sample would be.

It was not possible to include in the sample landowners of "abandoned lands" or absentee landowners--groups of definite importance to the land tenure "*latifundio*" hypothesis and of possible interest to idle-land considerations. The same bias is expected to be found in the census reports, since it is doubtful the census enumerator would have been more successful in contacting such persons.

3) Census reporting inaccuracies In trying to explain the discrepancies between census idle-land reports and the case-study findings, it is interesting to speculate how the census enumerator might have handled the abandoned or absentee-owned lands mentioned above. The

possibility that such lands might have been classified as idle is suggested by the separate census category of "no explotada" (i.e., not used) lands, of which the cultivable portion exactly equals the amounts of "descanso" (i.e., idle) lands. Without being able to interview the owners to determine if their lands were cultivable, it seems reasonable to expect that a disproportionate amount was classified as "cultivable but not used" (i.e., idle).

Lands previously cultivated and then converted to permanent pasture might also have posed problems for the census enumerator. Census instructions are unclear on how such land should be classified. The land is obviously cultivable, but it is not being cultivated. Classification with pasture land would remove it from the cultivable land category. Yet, within cultivable land no provision is made for such land use. The high proportion of idle land "for other reasons" may conceal such a classification dilemma.

Another area where misclassification might have occurred is in the category of land considered "susceptible to cultivation". As was encountered in Apatzingán, it would appear a different criterion was used for the ejido sector than for the private sector. Only 18 hectares (0.3 percent of the cultivable land) were considered as susceptible to cultivation in the private sector, whereas for the ejido sector some 5,294 hectares (or 115.6 percent of the cultivable land) were place in this category[268]!

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[268] Secretaría de Industria y Comercio. Cuarto Censos Agrícola. Resúmenes estatales. op. cit., Estado de Veracruz. Table 5.

Possibly the census enumerator considered some of the native pastures cultivable but idle, when they properly should have been considered susceptible to cultivation but not idle. Unfortunately, census ballots could not be examined for this region to more fully evaluate the method of reporting.

In Chapter VII, which follows, integration of the results for the state, county, and case-study levels at which tests were conducted in this chapter will be presented for each of the diagnostic hypotheses postulated in Chapter IV. Based on this integration of results, policy recommendations are then presented in Chapter VIII.

# VII. INTEGRATION AND INTERPRETATION OF RESULTS PERTAINING TO FACTORS INFLUENCING EXTENT AND NATURE OF IDLE LANDS

In the previous chapter, data were applied to the models described in Chapter V in order to test the diagnostic hypotheses postulated in Chapter IV. Before proceeding to development of remedial hypotheses in the form of policy recommendations for the idle land problem in Chapter VIII, interpretation and reconciliation of the results is required for the three levels on which the study was conducted. The present chapter integrates the state, county, and case-study findings and presents conclusions resulting from tests of the diagnostic hypotheses as to which of these hypotheses are upheld, rejected, or held in abeyance pending further study.

## A. Variables Directly Controllable by the Firm

### 1. Capital and credit (Hypothesis 1.1)[269]

At all levels of study, scarcity of capital and credit was found to be associated with idle land in the *ejido* sector. County level regression results indicated that the construction and machinery components of capital were most important in explaining idle land in the *ejidos*. Case study results supported these findings, demonstrating that credit was non-existent in many cases. Where extended, credit levels were often so low as to be exhausted in consumption expenditures and use on presently

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[269]For a complete description of this and other hypotheses considered in this chapter, see Chapter IV.

cultivated land, and thus were insufficient for use to reach cultivable areas being left idle. Not only was idle land found to be related to scarcity of construction and machinery capital, but even more noteworthy were the case-study indications of the lack of credit to purchase simple handtools and work-animals and to hire increased amounts of labor. The lack of credit for these basic production needs was an important factor contributing to the inability to cultivate all of the existing land holdings.

The relationship between idle land and capital in the private sector was less clear-cut. State-level regression results were not significant. This was predictable, considering the much higher levels of capital and greater credit availability common to those of the private sector having clear land title. At the county level, however, significant results were found for the machinery-capital variable. It was suggested that credit-availability problems of small private owners, which might have been concealed in state-wide aggregation, were able to find expression at the county level.

Little idle land in the private sector was uncovered in the case studies. This may be attributed in part to the uncommonly high amounts of credit and capital encountered. The few instances of idle land were found among smaller-sized holdings whose owners complained of insufficient credit. Thus, some support is lent to the thesis that credit problems of smaller farmers could be responsible for idle land. But further study is required to clarify the extent to which this is true.

To sum up, strong support is found for Hypothesis 1.1 for the ejido sector. Support is less clear for the private sector, wherein possible applicability appears limited to smaller-sized holdings.

2. Labor (Hypothesis 1.2)

Corroboration for Hypothesis 1.2 was found in the regression results at both the state and county levels for the private sector. Disaggregation of the labor variable at the county level yielded significant results for the producer, sharecropper and hired-labor classes. However, in contrast to the low national average figures, the case studies were characterized by large amounts of hired labor employed by the private sector. The only suggestion of labor shortages came from the more isolated holdings at peak harvest times. It appears that the relationship of labor to idle land in the private sector is largely a reflection of extensively farmed land holdings incorrectly classified as idle.

Ejido-sector labor results were somewhat surprising in their support for Hypothesis 1.2, considering the much higher average amounts of labor-utilization reported in the census for this sector. Although the labor variable was not significant at the state level, both family and hired-labor variables were significant at the county level in explaining idle land. This county-level finding was supported by the case study. Isolation of the ejido settlements, together with need for more hired labor, appeared to cause enough seasonal shortage to affect cultivation activities. Bearing in mind the labor shortages noted, the unwillingness to use periods of unemployment to clear lands takes on a greater dimension of rationality. These lands may have been left uncleared due to the fear that labor could become insufficient to harvest the crops. At the very least, it was apparent in both case-study areas that labor shortages would cause idle land if the size of holdings were to be increased.

Hypothesis 1.2 is thus supported for both land-tenure classes, but for different reasons. In the private sector the relationship of idle land to labor appears to be more a result of incorrect classification of large extensively farmed holdings than in the ejido, where seasonal scarcity of labor appears to directly influence the decision of how much land to cultivate, and how much to leave idle.

3. Technology (Hypothesis 1.3)

Support for Hypothesis 1.3 was found at the state level for the ejido sector and at the county level for the private sector. However, county-level results for the ejido contradicted those at the state level, and (adding the questionable adequacy of the fertilizer measurement) dictated that the findings be regarded as inconclusive, pending case-study clarification.

Case-study results supported Hypothesis 1.3. In the ejido sector, heavy reliance on traditional inputs resulted in low yields and a much lower opportunity cost of leaving land idle than in the private sector where modern technology was widely adopted. And, as hypothesized, higher levels of idle land resulted for the ejido sector[270].

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[270]A possible explanation (which supports Hypothesis 1.1) for the positive correlation between (footnote continued on following page)

Although the private livestock raisers did not have truly idle land, their lower rates of adoption of new technology in Apatzingán were accompanied by greater underutilization of lands compared to Alvarado livestock raisers, again supporting Hypothesis 1.3.

4. Land fragmentation and holding inaccessibility (Hypothesis 1.4)

Case-study results substantiated Hypothesis 1.4. Existence of non-contiguous and distant holdings were found to result in idle land, or failure to clear the land when closer holdings of larger size were owned. This type of problem was more frequent in the *ejido* than in the private sector.

Inaccessibility of the *ejido* settlements themselves appeared to be even more important than the inaccessibility of individual holdings as a cause of idle land. The lack of transportation between the *ejido* settlements and principal cities resulted in labor shortages, difficulty in obtaining new inputs, lack of contact with extension agents, banks, etc., and low on-farm product prices.

5. Title uncertainty (Hypothesis 1.5)

The case study provided substantial verification of Hypothesis 1.5 for both the *ejido* and private sectors. In the *ejido* sector the influence of unclear title on idle land was found to extend even beyond its effect

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(footnote continued from preceding page) fertilizer use and idle land encountered at the county level is also suggested by the case-study findings. Among the *ejidatarios*, use of non-traditional inputs was limited largely to commercial fertilizers. Under conditions of increasing returns to capital and severe credit constraints, fertilizer application (if given highest investment priority) could accompany intensive cultivation activities over a part of the holding, with the rest of the land being left idle.

on credit availability, as shown in an unwillingness to improve land holdings of unclear title. Surprisingly high proportions of private-sector holdings were also characterized by title uncertainty. Lack of clear land ownership was implicated as a cause of idle land for this sector also.

The special circumstances of the cattle sector merit separate consideration. Although not technically idle, vast areas of land were found to be severely underutilized because of fear that future expropriation could be hastened by using the lands more productively.

6. Irrigation development (Hypothesis 2.1)

Regression results at the state and county levels were difficult to interpret for the irrigation development measurements employed, unless recourse was made to census misclassification arguments. However, case-study evidence supported Hypothesis 2.1. For both the *ejido* and private sectors, the land left idle was always seasonal or unirrigated land. Nevertheless, the idle land practice was not intended to increase soil moisture.

## B. Variables Outside the Direct Control of the Firm

1. Land tenure (Hypothesis 2.2)

Results of the state-level regression analysis suggested that Hypothesis 2.2 should be rejected in favor of the *latifundio* hypothesis[271].

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[271] An explanation of the *latifundio* hypothesis is found on p. 144.

The simple correlations for both the ejido and private sectors also supported the latifundio explanation of idle land. Although the county level t values were somewhat lower, and less evidence for the latifundio hypothesis was found in the simple correlations, the amount of cultivable land in the private sector continued to demonstrate a significant positive correlation with idle land.

Case study results contradicted the findings of the state and county regression analyses. Despite their small holdings relative to those of the private sector, a much higher proportion of idle land was found among the ejidatarios. Within the ejido, the incidence of idle land appeared to be directly related to size of holding. By contrast, levels of idle land in the private sector appeared to lessen with size, if anything.

Attitudes conducive to idle-land practices appeared to be highly related to land tenure class. Among the ejidatarios there was widespread acceptance of idle land as the appropriate means of increasing soil fertility or simply "the right thing to do". Their desire for larger holdings to be able to leave land idle was the antithesis of the private sector's attitude which regarded idle land as a sign of ignorance or laziness. The traditional orientation found among the ejidatarios can be in part attributed to their low educational levels and to the isolation of the ejido settlements. Levels of, and attitudes towards, education were deterrents to acquiring and accepting new ideas to replace the traditional belief in idle land. The isolation of the ejidos resulted in lack of contact with the extension service, banks, growers associations, etc. as a source of exposure to new ideas.

It should be emphasized that the nature of the case studies was such that the latifundio hypothesis could not be completely dispelled. For example, absentee landlords could not be contacted. However, as pointed out under Hypothesis 3.4, there are strong indications that much of the alleged idle land in the private sector was actually underutilized land, whereas in the ejido sector the idle land encountered fitted more truly the census definitions.

2. Off-farm employment (Hypothesis 2.3)

State-level regression results were inconclusive for Hypothesis 2.3. Case study information was also limited since only those actively engaged in farming were interviewed. Even so, evidence was found which supported the validity of this hypothesis. Nearly one-third of the Apatzingan ejidatarios had participated in the Bracero program. Strong desire was voiced to participate in off-farm employment alternatives, rather than remain in the ejido. In Alvarado, where fishing employment alternatives were available, many had ceased to farm or farmed only sporadically.

Bracero experience found within the private sector did not appear to have caused idle land, since braceros had become private farmers after their bracero employment. However, it is interesting to speculate about the effect of off-farm employment on idle land among low income, private farmers, since sanctions against their leaving land idle would be less severe than those of the ejido sector (excluding illegal takeover). The direct and indirect evidence found suggest that Hypothesis 2.3 is correct for both sectors, although probably of less importance than alternative hypotheses.

## C. Largely Uncontrollable Variables

### 1. Regional weather characteristics (Hypothesis 3.1)

Both state and county-level regression results supported the contention that long-run or regional weather conditions were not important causes of idle land. The case-study approach did not provide a test of Hypothesis 3.1, since only hot, dry and hot, humid regions were studied. Both areas had substantial idle land, but no comparison was possible with long-run weather conditions of other areas.

### 2. Unseasonable weather (Hypothesis 3.2)

Although state-level regression results were significant, more precise weather measurement at the county level resulted in lower t values which were not significant at the five percent level. Since weather conditions preceding the case study interviews could not be considered unseasonable, no further test was provided for Hypothesis 3.2. It is likely that weather conditions should not be completely disregarded; at the same time neither do they appear to be among the more important causes of idle land.

### 3. Land quality (Hypothesis 3.3)

Results at the county and state level supported Hypothesis 3.3 for the *ejido* sector, but not for the private sector. The discrepancy between the two sectors could again be explained by resorting to the *latifundio* hypothesis. According to this argument, the *ejido* sector already was using all land available for cultivation, including land of poor quality (which was at times incorporated into an idle-land rotation scheme), while the private sector intentionally refrained from opening good lands to cultivation. Thus, poorer quality land and idle land would be related in the ejido, but not in the private sector. Case-study results substantiated this argument. Lands of poorer quality were in fact being cultivated by ejidatarios, with erosion and low soil fertility problems at times impeding cultivation and resulting in idle land. By contrast, in the private sector, lands of excellent cultivation potential were dedicated to extensive cattle-raising activities rather than to cultivation.

4. Census errors (Hypothesis 3.4)

In the state and county-level regression results, the weakness in the measurements of Hypothesis 3.4 made it difficult to accumulate conclusive evidence regarding census reliability. State-level census reports on land "susceptible to cultivation" did raise serious questions, especially regarding procedures applied to the private sector.

Case study results in Apatzingán confirmed these suspicions, presenting rather clear evidence of census misclassification in the private sector. High amounts of idle land attributed to the livestock sector, and apparent failure to carry out the required interviews, raise serious questions of census credibility. Allowing an overly generous interpretation of the reasons for census discrepancies, the native pasture land of the livestock sector could have been considered underutilized and nearly idle compared to its potential (yet certainly not idle according to census definitions). Although such direct evidence was lacking in Alvarado, the situation with regard to land classified as susceptible to cultivation suggested that incorrect classification had occurred there too. For the *ejido* sector in both regions, census reports of idle land appeared to be accurate.

In summary, idle land in the *ejido* sector appeared to be caused principally by title uncertainty, shortages of hired labor, and insufficient capital coupled with credit unavailability. However, a number of other factors converged which also encouraged the idling of land. These included low adoption of modern technology, poorer-quality holdings lacking irrigation development, holdings too small to sustain livestock-raising activities, and isolation of *ejido* settlements which resulted in low on-farm product prices. Prevalent attitudes among *ejidatarios* which were conducive to the idle land practice were reinforced by low levels of education and lack of contact with sources outside the *ejido* such as extension agents. Less important factors in causing idle land appeared to be fragmentation of holdings, acceptance of off-farm employment, and influence of unseasonable weather.

For the private sector, "causes" of "idle land" appeared to be chiefly title uncertainty, lack of irrigation development, and census errors in classifying underutilized holdings as idle. Lack of sufficient credit and acceptance of off-farm employment were implicated for small farms, with the influence of unseasonable weather remaining as a less important factor.

Auspiciously, the principal explanations of idle land were found to be variables controllable by the firm or by the government, rather than difficult to control or uncontrollable. Guided by these findings, a number of possible approaches to the amelioration of the idle-land problem are suggested in the form of remedial hypotheses in the next chapter. Evaluation of these recommendations may be of value in considering alternative solutions to the land-use problem.

# VIII. POLICY ALTERNATIVES AND RECOMMENDED PRIORITIES

An encouraging outcome of this study is the indication that idle land is largely governed by variables which are within the control of decision-makers. In line with objectives 4 and 5 delimited in Chapter I, the present chapter examines policy and research priorities which might be considered in attempting to remedy the idle-land problem as diagnosed in the previous chapters.

Ojala[272] has suggested that agricultural development policies can be classified into five categories. These include policies which are primarily directed towards: 1) institutional improvements; 2) generation of technical knowledge; 3) economic incentives; 4) purchasable input production and 5) agricultural infrastructure.

Although specific policies may not fit neatly into such a classification scheme, the conceptual framework is useful in pursuing an orderly evaluation of available policy alternatives. In the sections which follow, each policy class is considered, in what is deemed to be decreasing order of importance, as a means of resolving the idle land problem. Although not strictly idle, land underutilization in large livestock enterprises found in the case studies was so serious that it was considered desirable to include policy recommendations for these "nearly idle" lands.

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[272] Ojala, E. M. The programming of agricultural development. In Southworth, Herman M. and Johnston, Bruce F., eds. Agricultural development and economic growth. pp. 548-568. Ithaca, New York. Cornell University Press. 1967. p. 567.

## A. Institutional Improvements

If idle lands are to be brought into productive use, it is recommended that highest priority be placed on policies which would alter existing land-tenure and credit institutions. Results of the present study indicate that the effectiveness of other remedial policies will be greatly hampered unless action is first taken to improve the functioning of these institutions. In order of importance, four areas of institutional reform are considered. These areas are: a) land-tenure modifications in the private sector; b) land-title uncertainty in the small private and _ejido_ sectors; c) _ejido_ credit-system reforms, and d) alterations in the _ejido_ land-tenure system. Existing imperfections in each of these areas directly affect the movement of resources into the agricultural sector and the utilization of idle land resources. Improvements in institutions related to marketing, distribution, farmer cooperatives, etc. appear less crucial to the idle-land problem, although they may be of concern to the more general problem of agricultural development.

### 1. Land-tenure modifications in the private sector

The most important and probably most difficult institutional reforms involve alteration of land-tenure characteristics of large private holdings, especially those associated with livestock raising. A re-evaluation of existing land ownership and land redistribution policies is required at the highest levels of government if effective alterations are to be devised and implemented.

A principal problem needing attention is uncertainty of ownership. In part, the problem involves failure to register holdings or obtain clear title due to fear of expropriation if size of holding is revealed. However, even where holdings are properly registered, ownership uncertainty remains, being the result of frequent illegal occupation of land by squatters. This illegal occupation of land is sometimes accompanied by the burning of vehicles and buildings; theft of seeds, fertilizers and cattle; cutting of fences, etc. In areas with squatter problems, violence is common. Government troops have been utilized at times to expel these groups, but for political reasons government support is uncertain. The problem is not confined to cattlemen—over half of the private sector crop-growers interviewed also mentioned relations with squatters and *ejidatarios* as being a major concern to them.

The institutional imperfections which encourage this conflict have their origin in the expropriation and land redistribution policies which have continued since the beginning of the Revolution. The defensiveness of the livestockman, his caution in answering questions, and his reluctance to seek governmental assistance in ownership disputes are all readily understood in the context of their fear that their lands will be taken by the government for redistribution. This in turn stimulates expectations among the landless, who feel they have at least a tacit right to possess such lands.

It is especially unfortunate that even for smaller-sized private holdings, ownership uncertainty is caused by the illegal land occupation.

The indiscriminateness with which targets are selected is illustrated by the case encountered in Apatzingán of a cattleman with only 40 hectares who was unable to enter his occupied land.

The provision allowing ownership of sufficient land to maintain 500 head of cattle is probably the single provision which most encourages land-ownership conflict and the unproductive use of land. With such a criterion governing maximum legal size of holding, incentive is provided to keep lands ostensively unproductive (for government official appraisal), and to substitute high amounts of land for other inputs in livestock-raising activities. Owners of such large holdings may desire to keep these estates intact for a number of reasons. Prestige derived from estate ownership may be important; the desire to pass property on to heirs may be involved; "low cost" production of cattle in terms of purchased inputs is allowed; and, possibly most important, there may be the hope that someday the laws will be altered in ways more favorable to the livestock industry. Although such lands are not "idle" by strict census definitions, they are often nearly idle by any economic standard.

The granting of certificados de inafectabilidad[273] to the private cattle sector has also discouraged long-term investments in land improvements. Lacking incentives to develop their own land, even less incentive is provided to develop lands which explicitly become liable to governmental redistribution at a future time. Development of these lands would not only involve a loss of investment, but would also endanger the

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[273] Characteristics of these certificados are described on p. 213.

remaining land owned by the livestockmen, since it would reveal a higher productivity than they want known.

The ownership uncertainty described is expected to continue as long as an expropriation and redistribution policy is pursued to achieve the end of "a piece of land for all the landless peasants". To remove this uncertainty in the private sector, policies concentrating on a "once and for all land redistribution program" which would terminate by a specified date would be required. Even if the means selected took the form of mass expropriation it is felt such a program would be preferable (from the point of view of land use) than the present interminable programs with their concomitant uncertainty.

Somewhat limited incentive for land improvement might be provided were future expropriations to grant adequate compensation for long-term investments undertaken. However, it is doubtful such a policy alteration would provide sufficient incentive to be a significant force in accomplishing better utilization of land resources.

It is felt that the most effective program for encouraging more productive use of land would involve implementation of a progressive land tax. Such a tax would be based on potential agricultural productivity of the land, and would increase progressively with income-generating potential. The progressive nature of the tax could be adjusted to assure divestment of land in the more notorious cases of land-ownership concentration. It is recognized that such a program would be costly to administer. Land titles would have to be registered, extensive technical skills amassed for assessing land use capabilities and appropriate channels of appeal established. Above all, the will to judiciously enforce the provisions of the program would have to be present. If the will to provide honest enforcement is weak, then decision-makers will be forced to accept less desirable alternatives.

A land tax policy would encourage movement of land into higher-valued uses through tax pressures on underutilized land resources. These pressures would become more persuasive with the progressive nature of the tax. Incentive would be provided to disinvest in land and to substitute other inputs more in line with the input shadow prices. Initially a means of increasing agricultural production through more efficient use of land, the program could later become important in capturing part of the agricultural surplus generated, thus providing an investment fund for various development activities. The size of the fund would depend on the level of taxation and the ability to decrease enforcement costs as the program gained experience. An important advantage of this program would be the flexibility allowed in altering taxation levels, according to the goals and rate of change desired.

The importance of the progressive land tax is emphasized because it is felt that substantially greater amounts of idle land exist in the private sector than were found in the case studies. Several considerations support this belief: 1) approximately 10 percent of those for whom interviews were attempted in the private sector remained uncooperative; 2) those interviewed indicated that the idle land practice was widespread for both the <u>ejido</u> and private sectors (although less than census indications); 3) no private unirrigated cropland was found for inclusion in the sample; 4) no information about absentee owners or land abandonment was obtained.

It is frequently maintained that land is held as a hedge against inflation, for speculative motives, or for prestige, rather than for productive purposes. Such land, if left idle, would have gone undetected in the sample (especially if associated with absentee landlords or uncooperative respondents). Economic incentives encouraging this land to move into productive use could be extremely effective under such conditions.

2. <u>Land-title uncertainty in the small private and ejido sectors</u>

The amelioration of land-title uncertainty problems among <u>ejidatarios</u> and small private landowners is suggested as the area of institutional improvement requiring the next highest remedial priority. Case study results showed land-title uncertainty problems were widespread and appeared to be a dominant obstacle to efficient land use in general, and to idle land use in particular. Land title imperfections are directly related to the ineffective functioning of existing credit institutions--a topic discussed later in this section. Other consequences of unclear title include reluctance to improve land through long-term investments and fear of renting land to others.

The following explanations stand out as possible reasons for failure to clear land titles: 1) lack of understanding of their importance;

2) high costs and red tape associated with clearing title; 3) fear and discomfort experienced when dealing with authorities.

Interview results indicated that the need for clear title was already widely recognized. Thus, educating the farmer as to his legal rights, the steps required to clear title, and the expected costs involved is more important than pointing out the need for clear titles.

The high costs and arbitrariness of charges present a more formidable problem[274]. Minimum legal fees (normally $500.00 pesos or $40.00 U.S.), would usually not by themselves preclude title registration. However, this figure excludes notary public and extra-legal fees, and the high costs involved in those instances where judicial proceedings are necessary (such as the common case where land is passed intestate). Moreover, the latter fees present a significant obstacle due to the arbitrariness with which they may be exacted and the feeling of helplessness experienced by the peasant when confronted by highly educated professionals. There appears to be not only the fear of placing themselves in a vulnerable position in terms of having to pay taxes, fees, fines, etc. once the title defect is revealed, but that furthermore unscrupulous officials might take advantage of the title defect to deprive them of their lands.

Although title-clearing costs are important deterrents to title registration, they are often low enough, and the desire to obtain clear

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[274] Information as to legal fees is based largely on information provided by: Shirai, Pedro. Personal correspondence. Sept. 22, 1969.

title great enough, that remedial action might be expected. Yet continued failure to clear title may persist, due to fear of officials and the expectation of higher costs than those actually involved--in which case it would not be surprising that potential benefits of clear land title might be viewed as incommensurate with the costs and risks perceived by the peasant. This is especially true when there is doubt as to availability of credit even if title is cleared.

The _ejido_-private group studied in Alvarado provides an indication of the potential importance of clear land-title when accompanied by credit. This group lived in the _ejido_ and demonstrated attitudes, beliefs, and values similar to those of the _ejidatarios_. Yet ownership of private land with clear title gave them the ability to secure credit which resulted in a higher proportion of their _ejido_ holdings cultivated than that encountered among the other _ejidatarios_. Accompanying the lower incidence of idle land were more outside consultation with experts and greater use of modern inputs.

If the advantages of clear title are to be realized, the benefits must be increased or made more apparent to the farmer, and the costs or apparent costs must be decreased. On the cost side, problems include the ignorance of the peasant in legal matters, bureacratic entanglements, numerous fees to be paid, and illegal maneuvers. One set of policies could be aimed at reducing the indirect and direct costs of title registration by abolishing recording fees, providing tax exemptions for a certain number of years following title registration, granting of permanent land tax exemptions for smaller-sized holdings, etc. However, this type of policy, although possibly helpful in supplementing other programs, is not expected to provide sufficient incentive in itself to encourage extensive title registration.

To remedy the title registration problem, it is recommended that high priority be given to the initiation of a program which would bring legal services to the village level. Such a program could build on the success of previous Mexican experience in providing professional services in rural areas. The number of social welfare and health officials recruited for rural village programs has increased rapidly. Methods of placing federal schoolteachers and economic incentives are used to encourage service in rural areas. Medical students are required to complete an internship program of rural service as a part of their pre-credential training. However, to date, no program has been attempted which would bring the much-needed (and over abundant) services of the legal profession to the rural village.

For legal services to become effective at the rural level, a program is required which would provide frequent visits to the village (e.g., semi-monthly), always by the same person, at predetermined times and locations. In this way villagers could come to trust the official and identify him as "their lawyer" much as they do the doctors and teachers. The lawyer's primary function would be to instruct the farmers as to legitimate fees involved and their legal rights and to undertake legal action which would clear land titles. To avoid ostracism by village factions, local judicial committees could be utilized to screen out those cases where local disputes were involved. With time, legal services could be expanded beyond the land-title needs. In fact, lawyers could become a most important resource in bridging the gap between the rural population and governmental agencies.

An internship program of law students (similar to the medical assistance program) should be compared with the merits of a long-term professional service program granting appropriate compensation (such as that provided for teachers and social workers). Considerable Mexican experience with each type of program has already been gained for evaluating the problems and possibilities involved.

An alternative (or supplementary) program could draw on existing credit institutions for clearing titles. Costs to the peasant could be decreased by circumventing intermediaries or by providing low-cost service through government subsidies paid to the credit institutions. An important advantage of this approach would be to assure that before any title registration costs had been incurred, potential benefits of clear title would be realized in credit availability. Incentive payments could be made to the lending institutions, based on the number of new titles registered which were accompanied by agricultural loans. This could be used to encourage greater movement of financial resources into the agricultural sector, as well as to accelerate title-clearing activities.

Utilization of credit institutions in title registration is given lower preference than the village lawyer program, since there still would exist the problem of bridging the gap between the peasant and the banking officials. However, with the credit institution program, community-development agents other than lawyers could facilitate the personal contact required.

Title-clearing policies discussed above apply only to the poorer, less educated farmer. As indicated in the previous section (see p. 257), unclear title problems of private owners with large holdings are of a different nature. The magnitude of underutilization of land associated with these large holdings justifies the higher priority assigned to the private sector land reforms recommended earlier.

3. Ejido credit system reforms

A somewhat lower priority is suggested for credit system reforms than for the policies previously recommended. In the first place, measures are currently being undertaken by the government to encourage greater capital flows into the agricultural sector[275]. These measures should be evaluated before embarking on new approaches. Secondly, alterations of the credit institutions discussed herein will influence only

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[275]Especially noteworthy are the activities of the Fondo de Garantía y Fomento para la Agricultura la Ganadería y la Avicultura. Its efforts at supervised credit operations for small farmers are discussed in: Créditos de la AID a México. Mercado de Valores, v. 28, no. 26, pp. 425-426. June 24, 1968. Private bank endeavors are found in: Luenguas, Alfredo A. El crédito para la agricultura en pequeño. Text of speech presented at the Escuela Nacional de Agricultura, Chapingo, México. In: Mercado de Valores, v. 28, no. 24, pp. 298-404. June 10, 1968. The greater emphasis on long-term loans for land improvement and initiation of perennial crop activities is documented in: Préstamos del BID para el sector Agropecuario. Mercado de Valores, v. 28, no. 2, pp. 31-32. Jan. 8, 1968.

the ejidatarios and will not solve the idle-land problem which is found among large private landowners. Thirdly, the title-clearing policies would mitigate to a large degree problems impeding the effective functioning of existing credit institutions. Even granting the above considerations, credit scarcity would probably remain an important cause of idle land.

Credit reforms are most urgently needed in the ejido sector. Since ejido lands can not be mortgaged, a special Ejido Bank had to be created by the government. This bank has been the center of considerable controversy. The Ejido Bank has been criticized for its inadequate funds, lending irregularities, high costs of operation, poor timing of credit, and poor loan recoupment[276].

To a considerable extent, the Ejido Bank is torn between two philosophically divergent roles. On one hand it is expected to act as a welfare agency, helping the ejidatarios according to their needs and disregarding repayment capabilities. On the other hand, it is also expected to increase the productivity and commercialization of the ejido sector[277].

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[276] In addition to information cited in 201, 202, and 242, see Anderson, Charles W. Bankers as Revolutionaries. In Glade, William P., Jr. and Anderson, Charles W. The political Economy of Mexico. pp. 103-196. The University of Wisconsin Press. Madison Wisconsin. 1963. p. 152.

[277] Mention of the philosophical dilema of the Ejido Bank is made in: Ibid. p. 149, Soto Angli, José. Breve compendio de las funciones del Banco Nacional de Crédito Agrícola, S.A. In Fernández y Fernández, Ramón, ed. Crédito Agrícola, vol. VII. Centro de Economía Agrícola, Escuela Nacional de Agricultura. Chapingo, México. 1967. (pages unnumbered) and Silos. El Valle del Yaqui. op. cit.

One possible way of improving the functioning of the _Ejido_ Bank which could also increase its "record of success" would be to separate loans according to whether intended use was for living expenditures or production purposes. If the _Ejido_ Bank is to be maintained, the level of funding needs to be increased considerably. An accounting policy which distinguishes between production and consumption loans might create greater public understanding and support.

The use of local _ejido_ credit societies to insure loan repayment should also be re-evaluated. When credit societies fail to repay the loans, it seems counterproductive to penalize all members of the society for non-compliance of loan obligations on the part of some. Efforts must be directed towards isolating those individuals who fail to repay the loans from those who are creditworthy subjects. Presently the Bank is aided by the _ejidatario_'s favorable attitude towards credit use. This will soon dull if the recipients feel they are treated unfairly in loan-renewal policies.

Finally, the long-term effectiveness of the _Ejido_ Bank will depend on the will to prevent irregularities by bank employees. Lacking this will, it would probably be preferable to abolish the _Ejido_ Bank and turn to other alternatives. Consideration of possibilities along these lines are presented below.

4. _Alterations in the ejido land tenure system_

The present political climate dictates that low priority be given any reform of the _ejido_ system. Developed as an institution to implement the Mexican Agrarian Reform program, it has since become equated to the Revolution itself and therefore is almost beyond criticism[278]. Yet, in the long run, a re-evaluation of the *ejido* will become increasingly imperative.

The *ejido* was instrumental in facilitating the social, political, and economic goals desired by Mexico[279]. By giving land to landless peasants, political stability was maintained. The powerful absentee landed class was largely abolished, and a considerable degree of income redistribution was achieved. With the political stability, the government was free to follow a strategy of investment concentration in the highly productive modern agricultural and industrial sectors[280].

Even as the *ejido* has been dependent on the state, so has the state been, to a significant degree, dependent on the *ejido*. There are indications that this relationship is becoming increasingly less symbiotic. The government can now count on support from other sectors of the economy. At the same time, many *ejidatarios* appear to be disheartened by low income levels and a government which they feel has been neglectful.

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[278] An early and impressive exception is provided by: Girault, Manuel. El ejido--callejón sin salida. Problemas Agrícolas e Industriales de México. Vol. V, no. 4, pp. 1-26. 1953. Other statements critical of the ejido are found in: García Treviño, Rodrigo. Agrarismo revolucionario y ejidalismo burocrático. Problemas Agrícolas e Industriales de México. Vol. V, no. 4, pp. 27-66. 1953, and Fernández y Fernández, Ramón. El agrarismo mexicano. *op. cit.*

[279] See, for example: Glade, *op. cit.*, p. 27 and p. 59; Flores, Edmundo. Tratado de economía agrícola, *op. cit.*, pp. 377-378; and Simpson, Lesley, *op. cit.*, p. 297.

[280] Glade, *op. cit.*, p. 57.

Despite some disenchantment, the ejido structure has such close emotional association with the Revolution that it is difficult to encounter a politically feasible means of disentangling the government-ejido interdependence.

Against this background, it was decided to explore the feelings of the ejidatarios towards the ejido system in the case studies. Those interviewed expressed widespread favor of the ejido system as it now exists, despite their frequent complaints regarding the lack of governmental assistance and concern. Nearly all felt the laws should remain essentially as presently formulated. Due to the common fear that any deviation might precipitate a reversal to pre-Revolution land ownership patterns, strongest support was given to provisions stipulating that all land be farmed by the owners and that selling of ejido lands be prohibited.

Nonetheless, certain changes were viewed favorably by the majority. Most frequent approval was given to provisions which would allow lands to be mortgaged to secure credit. This modification was especially popular among the ejido-private group.

Attitudes towards their own ejido holdings were surprisingly different from attitudes towards the ejido system in general. Nearly all stated they would prefer to own their land outright as private property. Those favoring private ownership indicated that such a change would result in planting higher-valued crops and less idling of land. It is difficult to ascertain whether these changes would in fact result, or were simply a response forced by the nature of the questionnaire. Yet, it appeared previous thought had been given to the question. Besides the desire to be able to mortgage their land, many expressed the opinion that owning private land would prevent "involvement" in their affairs on the part of others. A number stated that private property "wouldn't belong to the government" and therefore couldn't be taken away by the government or others. Receptivity towards changes in the ejido system was especially high among the ejido-private group and ejidatarios in Alvarado (who had the strongest feelings of isolation and estrangement from the government).

Strong emotional ties to particular plots of land on the part of the peasant could indicate rigidities in the ejido system which could preclude alteration possibilities. Thus, it was necessary to ascertain the prevalence of such attitudes before changes in the tenure system could be suggested. Interview results revealed a rather weak emotional attachment to particular pieces of land. All were willing to trade their holdings for others of better quality or closer to their residences.

If a movement away from some of the ejido inflexibilities is desired, a first step could be a pilot project wherein amplification of ejido lands took the form of private property. Interview findings of the ejido-private group in Alvarado suggest such a step could be extremely productive, especially from the point of view of idle land[281]. It could also lessen some of the land-holding uncertainty problems arising from illegal manipulations practiced in some ejidos.

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[281] See pp. 195-196.

It would appear that the government may be overly sensitive to the possibility that ejidatarios would readily sell their lands, bringing about a return to the latifundio system. In this respect, it is significant that not one of the ejidatarios interviewed indicated willingness to sell their lands even if a change to private property was allowed. Nevertheless, it would seem wise to build safeguards against undesired sales. To the extent that effective legal services are developed at the village level, as recommended earlier, checks could be provided to minimize the chances that land sales might be undertaken against the wishes of the seller. Witness of sales by village lawyers or village committees could be required, which would assure that the seller was aware of the consequences of his action. Time intervals allowing change of mind on the part of the seller could be provided. Restrictions could be placed on purchaser eligibility with "buyer certificates" issued only to those with smaller-sized holdings or with derechos a salvo[282]. Limitations on lending institutions of their foreclosure procedures and subsequent land disposition could be established. If such checks and balances proved effective, then a long-run policy could be undertaken to shift ejido lands to private ownership.

A number of advantages might be expected from such a policy. Access to existing private lending institutions might be greatly enhanced rather than the forced reliance of the Ejido Bank and local lenders. Abuses of

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[282] A description of the derechos a salvo is found on p. 56. The legal basis for these rights is defined in Leyes. Codigo Agrario. Art. 81 and 85, op. cit., p. 34 and p. 35.

ejido presidents would be circumvented. More able farmers would be allowed to expand their size of holding within constraints designed to prevent excess concentration of land. Those desiring to leave agriculture would be able to do so without the penalty of having to completely give up their land rights. The incidence of land fragmentation could be decreased. Finally, antagonisms between the ejido and private sectors might diminish as the distinctions between the two groups became less apparent.

It will probably be noted that no policy recommendations have been advanced for the establishment of communal land tenure systems or colonization programs. These alternatives have been discounted because of expected high costs, complexity of problems encountered, and the low incidence of success in Mexico's previous attempts to implant these types of programs. The desire for communal ownership and tropical forest development espoused by many politicians is felt to have limited support among the peasants themselves. For the present, institutional improvements along the lines herein suggested are expected to provide a better solution to the idle land problem.

## B. Development and Diffusion of Technical Knowledge

To accompany the high priority placed on institutional improvements, heavy emphasis is recommended for policies to increase the input of technical knowledge at the village level, which would provide new options for idle land utilization. The following aspects of technical knowledge are considered in this section: (1) existing technical knowledge and beliefs about idle land; (2) lack of technical knowledge regarding alternatives to idle land; (3) suggestions for improving the dissemination of technical knowledge; and (4) census reforms to enhance usefulness for research and policy decisions. Somewhat lower priority is afforded to policies in this section than to institutional improvements, since they would apply more to the idle-land problems found among the less educated farmers with smaller holdings than to the underutilized holdings of large livestock enterprises.

1. Existing technical knowledge and beliefs about idle land

As evidenced in this study, the ejidatarios practiced idling of land due to the widely held belief that this was a desirable practice for maintaining soil fertility. In fact, there was the desire to increase the size of holding in order to be able to leave more land idle. The factor preventing more extensive idle land was often simply the small amount of land resources available--a fact demonstrated by the common indication that land was the most limiting of all resources. An important barrier to present and future productive utilization of idle land was thus found in the lack of technical knowledge regarding practices which would increase soil fertility.

The ejido-private group also viewed idle land favorably. But here, some use of commercial fertilizers was supplanting the idle land practice. This provides an indication that the beliefs held, though incorrect, are not insurmountable barriers to adoption of new inputs which improve land productivity. This finding has important implications for input policies which are considered later.

Within the private sector, knowledge about effects of idle-land practices was much closer to reality. This again points out the different motives for leaving land idle which require different policies for each sector.

2. Lack of technical knowledge regarding alternatives to idle land

The ability to bring idle land into productive use depends on the availability of technical knowledge about alternative land use practices. It can be seen that much of the needed knowledge has not yet been developed. In its stead, there appears the belief that idling of land is a proper response on the part of the peasant to his agricultural conditions. The situation is worsened by the denial of many "experts" that such a problem exists, or at least to any significant degree.

Although some soil fertility could be provided by re-growth of native nitrogen-fixing legumes, in most areas this would be of marginal importance--insufficient to compensate for the loss of a year's crop. Systematic incorporation of green manure crops to replace the idle-land rotation scheme would provide more effective means of increasing soil fertility. Research needs along these lines include evaluation of returns (in terms of fertility) from different types of green manure crops; levels of resources required; possibilities of combining harvesting activities with green manure practices, etc. Although more continuous cropping with commercial fertilizer may be the long-run goal, in the short run the use of green manures may be more feasible since they require less out of pocket expense. Gaining adoption of the green manure practice might also be easier since it more closely parallels traditional agricultural beliefs and activities.

Needs of non-irrigated agriculture is a second area for which greater research emphasis is recommended. Present research efforts have been largely concentrated on irrigated crops. A new research focus could result in increasing the opportunity-cost of leaving land idle in unirrigated areas. Alternatively, such research could demonstrate ways in which the idle land practices could be used more productively. For example, idle lands could provide important benefits in terms of increased soil moisture availability in arid regions. However, if idle land is to be used in this way (rather than to increase soil fertility), entirely different cultivation practices are required. Unfortunately, at present only in rare instances is the belief found that idle land could enhance soil moisture levels. This indicates that even after research results are forthcoming, diffusion of the technical knowledge to the village is likely to be difficult. Some of the problems associated with this diffusion process are examined below.

3. Suggestions for improving the dissemination of technical knowledge

For agricultural development to proceed at a more rapid rate, the technical knowledge disseminated must include much more than information about idle land. The ineffectiveness of present dissemination methods was revealed in the case studies. In Alvarado, no technical knowledge or assistance was reaching the *ejidatarios* from any government agency. In Apatzingán, limited technical information was reaching only a few of the *ejidos*.

The rural school, extension service, and credit agencies are the three existing institutions which could be used to spread new information regarding alternative uses of idle land. At present, the rural educational system's effectiveness in dealing with agricultural problems is impeded by an often narrow view of its mission. Emphasis is primarily placed on literacy skills and a basic curriculum which gives little attention to agricultural techniques and needs. The effectiveness of extension service and credit agency service is also limited, a situation which may be due to lack of funds, lack of interest in working with the smaller low-income farmers, a lack of technical competency, or a combination of all these.

A number of success elements are present which could facilitate the transmission of knowledge to the village. The granting of *ejido* lands is tied to the establishment of a school[283]. Each rural school is endowed with a parcel of land intended to be used to demonstrate modern agricultural techniques to the students and to the village. If there were closer cooperation between the school officials and the extension agents, these school plots could become the basis for diffusing existing agricultural

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[283] Leyes. Código Agrario. Art. 185-186, *op. cit.*, p. 67.

knowledge to the farmer[283a]. Presently such cooperation is rare and the school parcels are seldom used as intended.

Although variation was found between ejidos, within any ejido settlement great similarity in behavior was noted. This homogeneous nature of ejidatario behavior can also be considered as an element favorable to diffusion of technical knowledge. As an example, approaches to soil-erosion problems tended to take two divergent forms. In some ejidos, members appeared completely unaware of possible remedial action. A typical statement was: "I try to plow in straight lines, but I can't because the (erosion) canals get in the way". By contrast, in neighboring ejidos, erosion problems were minimal due to the effects of the Ejido Bank in encouraging adoption of contour farming practices. It appears that successful adoption of new techniques by a few is quickly imitated by the rest, especially if the techniques require little cash expenditure.

In many ejidos credit societies are already functioning which could provide the vehicle for introducing new methods, were the lending institution and extension service to cooperate in credit supervision and dissemination of technical knowledge.

To take advantage of the favorable elements enumerated above, considerable policy changes will be required. Ways of encouraging closer cooperation among school, extension, and credit officials should be

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[283a]An example of what could be achieved through cooperation of school officials, agricultural extension agents and health officials is documented in: Aguilera Dorantes, Mario and Castillo, Isidro. Santiago Ixcuintla. Un ensayo de educación básica. Secretaría de Educación Pública. México. 1970.

explored. Development of rural primary-school curricula more relevant to village conditions should be undertaken. More technical schools with an agricultural orientation are needed. More effort should be directed towards increasing the number of graduates from the agricultural colleges; but more important, candidate selection should include evaluation of previous agricultural experience and of willingness to work on practical agricultural problems identified at the village level. Until such policies are implemented, it is doubtful the extension service and other government agencies will become very effective in developing and transmitting the needed technical knowledge to deal with idle land and other agricultural problems.

4. Census reforms to enhance usefulness for research and policy decisions

Agricultural census reports could provide valuable knowledge for revealing research areas of high priority. Usefulness in this respect is presently lessened by indications that the census information is often unrealistic. Such indications are also found in the present study, especially for information about the private sector. Strong evidence was found to indicate falsification of census reports, which resulted in overestimation of the amount of idle land in the private sector.

Census reliability might be enhanced by development of a larger full-time staff of experienced interviewers, instead of resorting to crash training-programs. With full-time staff, control of reporting irregularities would be facilitated more than at present, when employment with the Bureau terminates shortly after completion of the interviews. Such a reorganization would also lend itself to more frequent reports based on sampling techniques rather than the complete survey once very 10 years. Information collected would also be more useful if it were along the lines of interest of policy-makers in Mexico (e.g., included greater detail by size of holding, clarification of *ejido*-private group classification, etc.).

## C. Economic Incentives

The need for entrepreneurial talent as a precondition of economic development is a common theme running through much of the literature. Such a responsive class of entrepreneurs must be shown to exist before policies emphasizing enhancement of economic incentives can be considered. In this section, evidence of an entrepreneurial class in Mexico is presented, and policies for providing economic incentives which could influence idling of land are evaluated.

Results of the case studies in this report suggest that entrepreneurial talent is already abundant in Mexico. In the private sector of Apatzingan, one grower illegally "imported" hybrid seed, and from it was developing his own varieties adapted to Mexican conditions. Another was leaving a small business to develop 400 hectares (largely idle) in a neighboring state. Still another was soliciting credit to expand his broom-export factory as the next step in vertical integration of his agricultural activities. In the ejido sector, examples indicative of ingenious entrepreneurial behavior were also found[284]. Unfortunately, expression of these talents is often suppressed in the ejido[285]. For example, a number of braceros returned with new ideas and abilities for increasing production, but could not secure the credit required to carry out their plans.

The need for stable prices, price guarantees, and better marketing methods was mentioned frequently by private farmers in Apatzingán. However, almost no idle land was found among these farmers. Such considerations were rarely, if ever, mentioned by those farmers who did have idle land. Thus, present agricultural output-pricing policies appear to provide adequate incentive for utilization of idle land. Input-subsidization policies would appear to offer some long-run opportunities for encouraging productive use of idle land, but in the short run they would require the prerequisites of land ownership certainty, credit availability, and knowledge of new technology to be effective. Use of economic incentives in the form of tax policies appears most promising in the area of a progressive land tax. Possibilities for encouraging more productive use of land resources by this means was discussed in detail under institutional improvement policies[286].

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[284] See, for example, p. 202.

[285] Poleman, op. cit., p. 17, and Fernández y Fernández. Estudios del problema agrario actual. op. cit. Also see 208.

[286] See pp. 259-260.

Price supports on a number of basic crops have already been set considerably above world market levels. Thus, price supports seem to provide sufficient economic incentive to use existing land resources, and should probably be left at present levels. Crop-insurance programs might supplement the price supports, but these would be expensive and would probably alter the cropping mix rather than bring idle land into cultivation. Present output taxes do not appear high enough to cause any great land-use disincentive. In the livestock sector, setting of standards and grades might encourage greater development of that industry. Repeal of price ceilings on meat might be especially effective in encouraging replacement of the "idle" lands with improved pastures.

It should be stressed that the lower priority accorded to policies directed at strengthening economic incentives is not due to a belief that the farmers are unresponsive to them. On the contrary, numerous examples were found where increased agricultural production was desired to take advantage of the high price supports. Such price and taxation policies might be desirable for various reasons, but their influence on idle land is expected to be minimal as long as the ability to respond to such policies is curtailed by the institutional problems and lack of knowledge examined earlier.

### D. Purchasable Input Production

A rather low priority is given to policies encouraging increased production of purchasable inputs. Purchasable inputs can be divided into traditional and non-traditional inputs. It is concluded that special policies to encourage production of non-traditional inputs are probably not needed, at least in the immediate future; however, higher levels of traditional inputs may offer some overlooked possibilities for encouraging more productive land use.

It is commonly assumed that traditional agriculture is already efficient in its use of traditional inputs, and moreover that low rates of return result from increased quantities of these inputs. According to this assumption, increased production can come only through introduction of new input bundles with high potential payoffs[287]. The present study contradicts this conventional wisdom regarding returns to traditional inputs in agriculture. Increased levels of traditional inputs in agriculture could lead to greater use of idle land.

Although idle-land practices were viewed favorably by ejidatarios, the principal reason found for leaving land idle was insufficient resources to expand cultivation. Responses clearly indicated that with small increases of land, other (traditional) inputs quickly became limiting. Those most frequently mentioned were animal power, hired labor, and hand tools.

As long as idle land exceeds the owner's desires and is due to shortages of traditional inputs, high priority should be given to policies

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[287] See, for example: Schultz, Theodore W. Transforming traditional agriculture. Yale University Press. New Haven and London. 1964. p. 5, and p. 24; and Millikan, Max F. and Hapgood, David. No easy harvest. Little, Brown and Company, Boston. 1967. p. 9 and p. 67.

increasing the levels and availability of these inputs. The attractiveness of traditional inputs is heightened by low "acceptance" costs, since their need is already recognized. An additional benefit could therefore result if supervised credit programs providing traditional inputs could later be modified to stress adoption of new inputs, once the confidence of the farmer was gained. To the extent that acceptance costs of modern inputs are decreased, externalities accrue to the traditional inputs beyond the simple increase in output attributable directly to these inputs.

When the limit is reached where idle land no longer exceeds the owner's desires, input policies could be emphasized which would bring any remaining idle land into productive use. At this point, traditional inputs used in non-traditional ways could be encouraged. Opportunities for such input use could be provided by green manure crops, land fallowed for water retention purposes, pastures which replaced the cultivation-idle land rotation scheme, etc. It is felt that only after these measures prove successful should the final step be taken of encouraging extensive production and use of non-traditional inputs (requiring more pervasive changes in knowledge, attitudes, skills, etc.).

1. Policies encouraging non-traditional input use

Policies encouraging increased use and availability of modern inputs will bear consideration over the longer run. Fertilizer prices appear to be an especially deserving candidate for scrutiny, due to the monopolistic position granted the industry in the Mexican economy. Seed import restrictions may also warrant examination. In general, however, sufficient quantities of modern inputs are available to the agricultural sector. Failure to use these inputs is not so much due to high price or unavailability, but rather to lack of incentives, knowledge, and credit.

## E. Agricultural Infrastructure

Lowest priority has been assigned to policies emphasizing the development of new agricultural infrastructure. This position appears warranted because: 1) much agricultural infrastructure has already been developed; 2) average costs of such projects tend to be high; 3) marginal costs of new developments are expected to increase while the marginal benefits decrease; and 4) the success of these large investments has frequently been less than anticipated.

The case studies showed that no irrigated land was left idle. It would seem to follow that irrigation development should continue to receive high priority. However, the Secretaría de Recursos Hidráulicos recently revealed that of the 1,500,000 hectares "under irrigation", 700,000 hectares, or nearly half, had been left idle or abandoned[288]. It seems imperative to analyze this situation before further expensive irrigation projects are initiated. Re-examination of project evaluation procedures is imperative when actual land cultivated is only one-half of the amount used to justify undertaking the projects.

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[288] El Heraldo. Jan. 21, 1971.

With decreasing returns to irrigation development expected as the more favorable irrigation sites are exhausted, alternative projects might be found to increase land productivity at lower cost. Land clearing activities could provide one alternative. However, success would depend on providing sufficient credit to farm the newly opened lands. In the past, recently cleared land has often reverted back to brushland, as insufficient resources forced the farmer to concentrate his activities on ever-smaller plots of land. Land-clearing cost estimates in the case study ranged from $200 to $2000 pesos per hectare. The higher figure would approach the gross income of the first year's crop, and thus would not be readily undertaken. At the lower end, high returns to land-clearing activities would result. Were land-clearing investments to be decided upon, it would seem advisable to coordinate off-season unemployed labor in cooperative programs, rather than initiate expensive large-scale government projects using heavy machinery.

Case-study results revealed a need for adequate secondary roads. In isolated ejido settlements development of secondary roads would encourage higher on-farm prices for agricultural products by decreasing transportation costs and diminishing monopoly elements present in the market. In addition, movement of modern inputs into the village would be facilitated. Probably the most important potential benefit to the village of secondary roads would be to allow greater accessibility to the extension service, credit institutions, and others providing rural services. Although discouraging idle lands, expensive investments like secondary roads must be justified on more broadly-based criteria than idle-land use alone.

Industries established in rural areas could offer employment during the slack periods, but release labor for times of peak need. Such industries might encourage cultivation of idle lands by providing off-farm employment, and a more even supply of agricultural labor. However, difficulties in discovering and establishing such industries, training workers, and providing the required inputs, suggest that this remedy should receive lower priority as a means of decreasing idle land than those alternatives discussed earlier in this chapter.

# IX. SUMMARY AND CONCLUSIONS

In this final chapter, the findings and conclusions of the study are summarized for each of the objectives set forth in Chapter I. The study demonstrates that: (1) There is much idle land in Mexico; (2) Idle land resources could be used for production; (3) Use of idle land could assist economic development in Mexico.

If existing small holdings are to be brought up to "minimum legal size", Mexico faces a land crisis. Were all idle land and potentially cultivable land immediately developed for production, this crisis would still remain. If the rural landless are also to receive land, the problem of finding sufficient land becomes even more intense. On the other hand, if sufficient land is not found for the peasants, the historic desire for land ownership could once again lead to political turmoil. Thus, efficient utilization of all available land resources is of great political as well as economic consequence.

As the population continues to grow rapidly, so must agricultural output, if the desired rate of increase of 2.7 percent in per-capita gross national product is to be realized[289]. It is doubtful that the agricultural sector can increase production and alter the product mix so as to meet projections of demand. As discussed in Chapter II, also doubtful is the capacity of the industrial sector to absorb in productive employment the labor force released from agriculture.

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[289] This "desired rate" is the one found in: Secretaría de Agricultura, et al. Proyecciones. op. cit., p. 13.

The high farm-to-city migration rates of the South Pacific and Gulf regions indicate that the agricultural sector cannot provide enough employment with its present base of cultivated land. However, opportunities for increasing this cultivated land base appear to be present, since these regions also have the highest percentages of idle land. The unemployment, discontent, and need for expensive services which are a result of farm-to-city migration suggest that more resources should be directed to the agricultural sector to stem this flow in a manner consistent with the nation's industrial capacity to provide job opportunities.

In view of the underemployment problems encountered, it is paradoxical that the greatest production deficits are predicted for those crops requiring high amounts of labor per unit of land.

In satisfying the first objective of this study, results of the case studies and of regression analysis (together with indications found in previous investigations) demonstrated that the idle land problem was very important (Chapter III and VI). It is concluded that use of idle land can help meet the desired levels of agricultural output and employment outlined in Chapter II.

The second objective of this study was to find out why land is left idle. As shown in Chapter VI, the problem of idle land in the private sector is not accurately reflected by the strict census definitions. The case studies suggest that much of the "idle land" in the private sector is actually underutilized brushland. It also appears that fraudulent reporting must be added to census misclassification errors as a reason for the high amounts of idle land reported. Beyond these "explanations", the study suggests that idle land among the large private farmers is caused by land-ownership uncertainty. Among the smaller private farmers, idling of land is encouraged by ownership uncertainty and by the lack of irrigation and of credit. Unseasonable weather and acceptance of off-farm employment are possible, but less important, reasons.

Considerable amounts of idle land were found in the ejido sector--averaging 23 percent of the cultivable area in Apatzingán and 45 percent in Alvarado. The principal reasons for this idle land were title-uncertainty, shortages of hired labor, and inaccessibility of credit needed to purchase work animals, hand tools, fertilizers, etc. Idling of land was also encouraged by low opportunity costs of leaving land idle--due to lack of irrigation, isolation of the ejidos (which resulted in depressed on-farm prices for agricultural products), and failure to use modern technology. Off-farm employment, unseasonable weather, and land fragmentation appear to be less important explanations. Contrary to popular belief, regional weather characteristics were not substantiated as explanations of idle land.

An important explanation for the persistence of the idle-land problem was found in traditional beliefs that idling of land is the proper way to restore soil fertility. These beliefs are easily perpetuated by lack of education and lack of contact with such outside influences as might alter them. Therefore, if other programs for decreasing idle lands are to succeed, the ejidatarios must be convinced that new ways of restoring soil fertility are superior to the traditional way of leaving land idle.

Land-tenure findings also contributed to the explanations of idle land. Much idle land was found in the _ejido_ system, as had been hypothesized. Support of the _latifundio_ hypothesis was also found, although information about absentee landlords was not secured. The case-study findings for extensive holdings used for livestock raising indicated that their "idle" land problem is more properly described as one of land-underutilization. In the private crop-sector idle land was of rare occurrence.

The third objective of this study was to evaluate the relative importance of those variables found to explain idle land. The study suggests that the most important causes of idle-land stem from the land-tenure system. In the private sector, idle land results from ownership-uncertainty and legal provisions which discourage cultivation of large holdings. For the _ejido_ sector, important causes of idle land (which are worsened by the land tenure system) include traditional beliefs favoring idle-land practices, ownership uncertainty, isolation of the _ejido_ settlements, and lack of credit to purchase both traditional and modern inputs.

Policies to remove these causes of idle land (the fourth objective of this study) emphasize institutional improvements and the development and diffusion of technical knowledge. Within the institutional framework, policies emphasizing reform of existing land-tenure and of credit institutions are granted greatest remedial importance. For the private sector, the pervasive ownership-uncertainty problems encountered lead to the recommendation that land re-distribution policies (the main source of this uncertainty) be terminated as soon as possible. In so doing, provisions defining land-ownership limits in terms of animal-carrying capacity of the land will be abolished, thus removing a major cause of land underutilization.

To assure that these extensive holdings do not remain idle once existing penalties for more intensive land use have been removed, a land tax is recommended. To induce the best use of land, the tax would be based on some reasonable estimate of the land's productivity. To the extent that Mexico values redistribution of wealth more than efficient use of land, the tax should be progressive in nature. Replacing land-redistribution policies with a progressive land tax would decrease ownership-uncertainty, and would replace present disincentives with incentives for intensive land use.

Widespread title-uncertainty problems were discovered in the small private and ejido sectors. Here, if titles were not registered, it was not for fear of expropriation, but for the cost (actual or envisioned) and discomfort involved. To remedy this situation, it is recommended that attention be given to providing legal services at the village level. Title-registration cost reforms are also suggested, including the abolishment of registration fees and the granting of tax exemptions for small holdings. Existing credit institutions could be used an an alternative or supplement to village legal services as a means to encourage title registration, especially if registration were accompanied by granting of credit.

*Ejido* credit-system reforms are given somewhat lower priority as a means of bringing idle land into production, since their effectiveness is highly contingent on possession of clear titles by the farmers seeking credit. Only a small proportion of the *ejidatarios* receive credit from the *Ejido* Bank. For those receiving credit, the average size of loan is only about 200 dollars. The *Ejido* Bank's record of poor loan-recoupment may be one cause of its low budgetary support. Better public understanding is needed of the problems inherent in expecting a single banking institution to meet the welfare needs of the *ejidatarios* (with little regard for re-payment possibilities), and at the same time, increase the productivity and commercialization of the *ejido* through sound lending practices.

To enhance public understanding and support, it is recommended that an accounting procedure be adopted which distinguishes between loans made for living expenditures and those made for production purposes. It is also recommended that loans be made directly to individuals rather than to credit societies, so that credit-worthy *ejido* members will not be victimized by poor performance of other *ejidatarios*. However, in the long run, effectiveness and public support of the *Ejido* Bank will depend on the will to prevent irregularities in the handling of funds. To the extent this will is lacking, policies directed at reforming the whole *ejido* land tenure system (considered next) should be undertaken, rather than reforming the *ejido* credit system alone.

In the present political climate of Mexico, criticisms of the *ejido* are apparently not well received. Nevertheless, case study results, together with criticisms voiced by other investigators[290], lead to the belief, that, in the long run, changes in the *ejido* land tenure system will have to be considered.

It is recommended that as a first step in reforming the *ejido*, enlargements of existing *ejido* grants take the form of private property. The differences found between the *ejidatarios* and the *ejido*-private group of Alvarado seem especially persuasive. Access to credit and greater independence in decision-making provided by the additional privately-owned land resulted in more intensive utilization of land, greater adoption of new technology, higher aspirations for themselves and their children, and a more favorable view of education.

If the results prove successful on a pilot project basis, then, if continued land redistribution policies were insisted upon, at least land grants could take the form of private property when so desired by the recipient.

Reluctance of policy makers to change the *ejido* seems largely due to the fear that pre-Revolution land-concentration patterns would ensue. Although sharing this concern, nonetheless, the *ejidatarios* interviewed expressed strong desires to own their *ejido* plots as private property.

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[290] See p. 269.

At the same time, little interest was expressed in selling their holdings if alienation of ownership rights were permitted. It would appear that careful restraints placed on buyer and seller rights could be devised which, like the ejido, would prevent excessive land concentration, but which would avoid some of the rigidities of the ejido system.

Development and diffusion of needed technical knowledge is accorded high priority, along with the institutional reforms. Low educational levels and inaccurate beliefs about the benefits of idle-land practices attest to the need for such policy measures, especially for the ejido sector. However, diffusion of information about alternative uses of idle land must be preceded by more knowledge about the subject. Recommended areas for research on idle land problems are reviewed later in this chapter. Once the technical knowledge in generated, dissemination could be enhanced by policies encouraging closer cooperation between the rural schools and the extension service. However, both the development and diffusion of the needed technical knowledge are contingent upon the willingness of professionals to attack practical agricultural problems at the village level. At present, such personnel are exceedingly scarce.

Policies directed towards economic incentives and purchasable input production are afforded lower priority. This study suggests that lack of economic incentives and modern inputs are not the immediate factors limiting the use of idle lands. Price-responsive entrepreneurs are abundant and attractive price supports already exist for a number of crops.

Modern inputs are extensively produced in the country. Although input-subsidization policies might encourage greater use of idle land in the long run, their effectiveness appears contingent on the institutional reforms, availability of credit, development of information, and extension of this information to the farmer, as discussed earlier.

Two instances are found whereby policies enhancing economic incentives might effectively influence the amounts of idle land. The first possibility is the progressive land tax discussed under institutional reforms. The second possibility would be to remove price ceilings imposed on meat and livestock products. As greater development of the livestock sector is encouraged through such policies, conversion of idle land to improved pastures is likely to occur.

Lowest priority is afforded those policies emphasizing new agricultural infrastructures. Before continuing with heavy irrigation-project investments, it would seem advisable to determine why nearly half of the land within these projects is left idle. Secondary-road construction could reduce idle land in some areas, yet such investment appears much too expensive to justify on the basis of its influence on idle land alone. Land clearing activities offer some possibilities for bringing idle land into production. However, the effectiveness of land clearing programs will depend upon the success of the institutional reforms suggested earlier.

It is asserted that the future agricultural development of Mexico can come only from increased yields per hectare through use of modern technological inputs, since increased output can no longer be brought about by enlarging the cultivable land base[291]. No mention is made of increasing production through use of idle land, even though, as a rough estimate, cultivable land could be doubled if existing idle-land resources were used. The present study suggests that idle land utilization may well provide a desirable way to increase the cultivable land area.

It has been suggested that rather massive amounts of modern inputs are required to develop traditional agriculture[292]. Without belittling the possible benefits of improved technology, the present study concludes that the possibility of greater use of traditional inputs should not be disregarded *a priori*. It would appear that high returns are experienced when traditional inputs--in the form of animal power, hired labor, and hand tools (facilitated by small amounts of credit)--are applied to the land.

The fifth objective was to identify research needs as suggested by the results of this study. Additional case-studies in other areas are needed to provide data about the extent and causes of idle land under different conditions. In this regard, the Northern Pacific Region, and especially the State of Sonora, offer interesting areas for research. The rather dramatic reductions in idle land reported in the Census for this state and region[293] suggest that fruitful research could be undertaken in identifying reasons for both the previous high amount of idle land, and for its rapid decrease.

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[291] See, for example, Freebairn. *op. cit.*, p. 34.

[292] See p. 283.

[293] See p. 85.

Another interesting topic for research would be the investigation of the reasons for the idle land increase among holdings of less than five hectares at a time when the other land-tenure classes reported a trend towards decreased amounts of idle land. There is also the need to refine the present research by including greater detail on size of holding for holdings over five hectares. The grouping of all holdings over five hectares in a single category provides an insufficient basis for testing the influence of land tenure on idle land. The Guatemalan case studied by Fletcher, *et al.*, makes a more detailed study by size of holding especially intriguing[294]. In Guatemala, medium-sized holdings (7 to 45 hectares) reported considerably higher levels of idle land than holdings under seven hectares. Based on the findings of Mexico, the following interpretation is suggested: Where the practice of idling of land is viewed favorably by the peasant, increased size of holding allows fulfillment of the desire to leave land idle. If such an interpretation is substantiated for both countries, then credence is given to the assertion contained herein; that, to the extent land redistribution is directed towards present owners of *minifundios* instead of landless peasants, greater idle land is likely to result, rather than increased production per unit of land.

Another dimension which was not treated in the present study was the idle-land situation in newly-developed irrigated areas. It would be most valuable to ascertain why abandonment and idling of land in these areas

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[294] Further discussion of this study is found on pp. 78-80.

is so high[295]. Such reports are most surprising in view of the Apatzingán findings, where the reverse was found to be true--that is, lands depending on seasonal rainfall, not irrigated lands, were left idle.

More research is necessary to provide the technical information needed to achieve higher utilization of presently idle lands. Examples mentioned in this study include investigation of returns to, and resource requirements of, rotation systems using different green manures or using fallow lands for water retention. Research is needed to determine returns to land-clearing programs, and to investments in traditional and modern inputs where idle land is found.

The final objective of this study was to evaluate the usefulness of census data for conducting future economic research. This study concludes that census information appears to have considerable validity for the <u>ejido</u> sector, but is more questionable for the private sector. A number of specific improvements in Census data are recommended in Chapter VIII. Some of the changes suggested include use of sampling techniques, more frequent data collection, utilization of full time, trained staff for interviews, and greater breakdown of data by including more detail on size of holdings for both the <u>ejido</u> and private sectors. It is also recommended that information collected for the less than five hectares category be the same as that collected for the other categories. Tabulation of county information with the same amount of detail as the state level tabulations, and presentation of the <u>ejido</u>-private group in

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[295]Further discussion of this problem is found on p. 285.

an unambiguous, separate category, would also improve the usefulness of the Census.

As an initial attempt to investigate the idle-land problem in Mexico, the present study is limited in part by the nature of the data used. The linear regression model includes only those factors for which quantitative data are available. Since such data are scarce, and contain serious limitations, it should not be surprising that the empirical models fail to yield explanations with the finality desired. More refined procedures can, and hopefully will, be developed, particularly as data are improved. The 1970 Census may well provide valuable information to supplement this study.

Finally, it becomes apparent that bringing idle land into cultivation can only buy time for the agricultural sector of Mexico. If population increases continue at the present rate, modern inputs and new technology must be developed and adopted at a more rapid rate if the agricultural sector is not to become the braking force in Mexico's endeavors to provide sustained increases in per-capita income.

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# XII. APPENDIX I--TABLES

Table A.1. Available nutrients per capita for 1940, 1960 and 1965 and recommended minimum allowances[a]

| Nutrients | 1940 | 1960 | 1965 | Recommended minimum allowances |
|---|---|---|---|---|
| Calories | 1991 | 2507 | 2667 | 2600 |
| Protein, total (gm.) | 54.3 | 71.9 | 76.5 | 75.0 |
| Protein, animal (gm.) | 17.1 | 20.5 | 22.7 | 30.1 |
| Calcium (mg.) | 765 | 986 | 1100 | 600 |
| Iron (mg.) | 14.9 | 19.5 | 21.9 | 18.0 |
| Vitamin A (mg.) | 0.642 | 0.667 | 0.797 | 1.800 |
| Riboflavin (mg.) | 0.74 | 0.95 | 1.03 | 1.90 |
| Thiamine (mg.) | 1.74 | 2.31 | 2.43 | 1.30 |
| Niacin (mg.) | 20.0 | 26.1 | 26.5 | 21.5 |
| Ascorbic acid (mg.) | 42 | 62 | 60 | 85 |

[a]Source: Ramírez and Chávez. op. cit., pp. 1077-1082, and Secretaría de Agricultura y Ganadería, et al. Proyecciones. op. cit., pp. 91-93.

Table A.2. Daily per capita caloric intake, by income level, 1963[a]

| Monthly income in pesos | Daily per capita caloric intake | | |
|---|---|---|---|
| | Urban | Rural | Total |
| 0- 300 | 2407 | 2561 | 2543 |
| 301- 600 | 2202 | 2671 | 2558 |
| 601-1000 | 2253 | 2612 | 2487 |
| 1001-1500 | 2410 | 2777 | 2551 |
| 1501-3000 | 2398 | 2774 | 2534 |
| 3001-4500 | 2644 | 2886 | 2737 |
| 4501-6000 | 2513 | 2912 | 2592 |
| over 6000 | 2525 | 2907 | 2564 |
| average | 2377 | 2667 | 2551 |

[a]Secretaría de Agricultura y Ganadería, et al. Proyecciones. op. cit., p. 92.

Table A.3. Red meat consumption in North and South American countries, 1965[a]

| County | Kilograms consumed per inhabitant |
|---|---|
| Uruguay | 95.2 |
| United States | 94.9 |
| Argentina | 82.9 |
| Canada | 67.2 |
| Columbia | 27.2 |
| Brazil | 26.2 |
| Chile | 24.0 |
| Venezuela | 22.0 |
| Dominican Republic | 20.0 |
| Central American Free Trade Association Countries | 19.0 |
| MEXICO | 19.0 |
| Peru | 15.0 |
| Ecuador | 14.0 |

[a]Consumo de Carne en América Latina. Mercado de Valores. Vol. 28, No. 2. Jan. 8, 1968. p. 27.

Table A.4. Daily per capita animal protein consumption, by income level, 1963[a]

| Monthly family income, in pesos | Total | Urban | Rural | Daily per capita animal protein consumption (gms) Urban | Rural |
|---|---|---|---|---|---|
| 1,000 and under | 61.8 | 38.3 | 77.3 | 15.5 | 11.1 |
| 1001-4500 | 33.2 | 50.8 | 21.4 | 29.1 | 26.7 |
| 4501 and over | 5.0 | 10.9 | 1.3 | 43.2 | 35.4 |
| Total, all families | 100.0 | 50.7 | 49.3 | 25.0 | 15.0 |

[a]Secretaría de Agricultura y Ganadería, et al. Proyecciones. op. cit., p. 93.

Table A.5. Comparison of the agricultural sector's contribution to gross national product in 18 Latin American countries, 1965[a]

| Country | Percent of labor force in agriculture (1) | Agricultural contribution to GNP as a percent of total GNP (2) | Relative agricultural productivity (2)/(1) |
|---|---|---|---|
| Uruguay | 18 | 15.3 | .85 |
| Argentina | 21 | 16.7 | .80 |
| Paraguay | 52 | 36.5 | .70 |
| Ecuador | 53 | 34.2 | .65 |
| Honduras | 66 | 43.0 | .65 |
| Costa Rica | 49 | 31.2 | .64 |
| Brazil | 52 | 30.7 | .59 |
| Columbia | 52 | 30.3 | .58 |
| Nicaragua | 60 | 35.0 | .58 |
| El Salvador | 60 | 30.0 | .50 |
| Panama | 46 | 22.0 | .48 |
| Dominican Republic | 57 | 23.5 | .41 |
| Bolivia | 68 | 28.0 | .41 |
| Guatemala | 73 | 28.4 | .39 |
| Peru | 50 | 18.5 | .37 |
| Chile | 28 | 10.2 | .36 |
| MEXICO | 53 | 15.9 | .30 |
| Venezuela | 32 | 7.1 | .22 |

[a]Source: Agency for International Development. op. cit. Latin America Section. pp. 4, 5, and 11.

Table A.6. Federal governmental investment in agriculture, 1967-1969

| | 1967[a] | | 1968[b] | | 1969[c] | |
|---|---|---|---|---|---|---|
| | Expenditures | Relation to total budget | Expenditures | Relation to total budget | Expenditures | Relation to total budget |
| | million pesos | (%) | million pesos | (%) | million pesos | (%) |
| Irrigation | 2,024.2 | 9.6 | 2,940.0 | 9.8 | 2,224.1 | 8.4 |
| All other agriculture, forestry and fishing | 380.8 | 1.8 | 540.0 | 2.2 | 679.6 | 2.6 |
| Total for agriculture, forestry and fishing | 2,405.0 | 11.4 | 2,450.0 | 12.0 | 2,903.7 | 11.0 |

[a]Actual figures. La economía. IV informe Presidencial. Mercado de Valores. Vol. 28, No. 37, pp. 585-604. Sept. 9, 1968. p. 585.

[b]Preliminary estimates. Ibid. p. 585.

[c]Preliminary estimates. Presupuesto de egresos de la Federación para 1969. Mercado de Valores. Vol. 28, No. 53, pp. 837-856. Dec. 30, 1968. p. 843.

Table A.7. Area developed through public irrigation works, by region[a]

| Region | Prior to 1947 (thousand hectares) | 1947-1960 (thousand hectares) | Total (thousand hectares) |
|---|---|---|---|
| North Pacific | 150.5 | 463.0 | 613.7 |
| North | 154.2 | 267.1 | 421.3 |
| Central | 113.4 | 200.3 | 313.7 |
| South Pacific | 1.4 | 38.4 | 39.4 |
| Gulf | 0.4 | 27.4 | 27.8 |

[a]Compiled from information contained in Venezian and Gamble. op. cit., p. 119.

Table A.8. Annual rate of increase in economically active population

| | 1940-50[a] (percent) | 1950-60[b] (percent) | 1960-70(est)[c] (percent) |
|---|---|---|---|
| Economically active population | | | |
| Agricultural | 2.4 | 2.3 | 1.5 |
| Non-agricultural | 5.5 | 4.1 | 5.2 |

[a]Eckstein. El marco macroeconómico. op. cit., pp. 149-151.

[b]Ibid.

[c]Secretaría de Agricultura, et al. Proyecciones. op. cit., pp. 37-38.

# XIII. APPENDIX II--DERIVATION OF THE REGRESSION VARIABLES

## State Level Models

$X_1$: Percentage of cultivable land (in *ejidos* and in private holdings of more than five hectares) which is left idle for reasons other than rotation.

Source: Secretaría de Industria y Comercio. Cuarto censos agrícola. Resumen general. *op. cit.* Idle land for other motives (Table 22, part 2, column 4) net of holdings under five hectares, is divided by cultivable area net of holdings under five hectares (Table 22, part 1, column 2).

$X_2$: Total capital per cultivable hectare on private holdings of more than five hectares.

Source: *Ibid.* Value of capital in the form of machines, implements, vehicles, utensils, and hand tools for holdings of more than five hectares (Table 13, columns 7 and 8), is divided by cultivable area for private holdings of more than five hectares (Table 22, part 1, column 2).

$X_3$: Total capital per cultivable hectare on *ejido* holdings.

Source: i.q. $X_2$.

$X_4$: Percentage of total cultivable land in private holdings of more than five hectares.

Source: *Ibid.* Cultivable area in holdings of more than five hectares (Table 22, part 1, column 2) is divided by total cultivable area for the state (Table 22, part 1, column 2).

$X_5$: Percentage of cultivable land in *ejido* holdings.

Source: i.q. $X_4$.

$X_6$: Percentage of total cultivable land on private holdings of more than five hectares which is actually irrigated.

Source: *Ibid.* Area actually irrigated during the agricultural year for holdings of more than five hectares (Table 19, part 2, column 7) is divided by cultivable area of private holdings of more than five hectares (Table 22, part 1, column 2).

$X_7$: Percentage of total cultivable land in <u>ejido</u> holdings which is actually irrigated.

Source: i.q. $X_6$.

$X_8$: The ratio of urban to rural minimum legal wages.

Source: Information contained in: Comisión Nacional de los Salarios Mínimos. Salarios mínimos por zonas y minicipios. 1964-65. México 1964. Average state levels established by this commission in its first year of operation are assumed to be similar to those wage differentials existing in 1960.

$X_9$: Percentage of the total area of a state considered to be influenced by cities with a population of over 70,000.

Source: City size information is taken from: Secretaría de Industria y Comercio. Dirección General de Estadística. Octavo Censo General de Población. 1960. México. 1963. Concentric circles were superimposed on a map with the radius for each city with population exceeding 70,000 determined by the following criteria:

| city population | radius of influence (kilometers) |
|---|---|
| 70,000-100,000 | 25 |
| 100,000-150,000 | 75 |
| 150,000-200,000 | 100 |
| 200,000-300,000 | 125 |
| 300,000-1,000,000 | 150 |
| over 1,000,000 | 200 |

The approximate total area covered by each concentric circle was then summed and expressed as a percentage of the total area of that state.

$X_{10}$: A measure of aridity in 1959 relative to average aridity over a 20 year period.

Source: Numerator calculated from 1959 data contained on original reporting cards with: Secretaría de Agricultura y Ganadería. Dirección General de Geografía y Meteorología. Servicio Meteorológico Nacional, and from: Secretaría de Agricultura y Ganadería, Dirección General de Geografía y Meteorología, Servicio Meteorológico Nacional. Boletín del servicio meteorológico nacional. 1959. Tacubaya, D. F., México. 1959. Denominator calculated for 20 year periods based on the average of all reporting stations for each state found in: Soto Mora, Consuelo and Jáuregui O., Ernesto. Isotermas extremas. <u>op. cit</u>.

Aridity measurement used was computed as follows:

$$I_A = \frac{100\ (T_m + 45)}{Q} \qquad \text{where} \qquad Q = \frac{100\ P}{(T_M - T_m)^2}$$

and, where

$I_A$ = the aridity index

$T_M$ = average maximum temperature of the hottest month

$T_m$ = average minimum temperature of the coolest month

$P$ = average annual precipitation

$X_{11}$: $(X_{12})^2$, as a measure of the combined effects of extreme aridity and wet tropical conditions.

Source: i.q. $X_{10}$ denominator.

$X_{12}$: A measure of average aridity over a 20 year period.

Source: i.q. $X_{10}$ denominator.

$X_{13}$: A measure of labor utilized per cultivable hectare on private holdings of more than five hectares.

Source: Secretaría de Industria y Comercio. Cuarto censos agrícola. Resumen general. op. cit. Number of male workers 15 years and older employed in private holdings of more than five hectares (Table 12, part 1, column 2) is divided by cultivable area in holdings over five hectares (Table 22, part 1, column 2).

$X_{14}$: A measure of labor utilized per cultivable hectare on *ejido* holdings.

Source: *Ibid*. Number of male workers 15 years and older employed in *ejido* holdings (Table 42, part 1, column 2 and 4, and part 2, column 2) is divided by cultivable area in *ejido* holdings (Table 22, part 1, column 2).

$X_{15}$: Percentage of total pasture which is located on hillsides rather than on the plain.

Source: *Ibid*. Area in hillside pasture (Table 2, part 3, column 4) is divided by total pasture on hillside and flat lands (Table 2, part 3, column 4 plus column 2).

$X_{16}$: Percentage of total cultivable land in private holdings of more than five hectares on which fertilizer application is practiced.

Source: Ibid. Cultivable area in holdings of more than five hectares benefited during the agricultural year with manure, fertilizers and soil conditioners (Table 22, part 2, column 5) is divided by cultivable area in holdings of more than five hectares (Table 22, part 1, column 2).

$X_{17}$: Percentage of total cultivable land in ejido holdings on which fertilizer application is practiced.

Source: i.q. $X_{16}$.

$X_{18}$: Percentage of cultivable land held in private holdings of more than five hectares which is susceptible to cultivation, but which has not yet been opened to cultivation.

Source: Ibid. Area in private holdings of more than five hectares which could be opened to cultivation in an easy and profitable manner (Table 22, part 2, column 6) is divided by cultivable area in holdings of more than five hectares (Table 22, part 1, column 2).

$X_{19}$: Percentage of cultivable land in ejido holdings which is susceptible to cultivation but which has not yet been opened to cultivation.

Source: i.q. $X_{18}$.

## County Level Models

$X_1$: Percentage of cultivable land, in ejido and private holdings of more than five hectares, which is left idle for whatever reason.

Source: Secretaría de Industria y Comercio. Cuarto censos agrícola. Resúmenes estatales. op. cit. Total idle land found in private holdings of more than five hectares and in ejidos (Table 5, column 9), is divided by cultivable area in private holdings of more than five hectares and in ejidos (Table 5, column 2).

$X_2$: Percentage of cultivable land in ejido holdings which is left idle.

Source: Ibid. Total idle land in ejidos (Table 5, column 9) is divided by cultivable area of ejido holdings (Table 5, column 2).

$X_3$: Percentage of cultivable private holdings of over five hectares which is left idle.

Source: Ibid. Total idle land in private holdings of more than five hectares (Table 5, column 9) is divided by cultivable area in private holdings of more than five hectares (Table 5, column 2).

$X_4$: Capital per cultivable hectare on *ejido* holdings in the form of construction of buildings, barns, etc.

Source: Ibid. Value of capital in the form of buildings on *ejido* holdings (Table 3, column 4) is divided by cultivable area of *ejido* holdings (Table 5, column 2).

$X_5$: Capital per cultivable hectare on private holdings of over five hectares in the form of construction of buildings, barns, etc.

Source: i.q. $X_4$.

$X_6$: Capital per cultivable hectare on *ejido* holdings in the form of irrigation works and equipment.

Source: Ibid. Value of capital in the form of irrigation equipment and installations on *ejido* holdings (Table 3, column 6) is divided by cultivable area of *ejido* holdings (Table 5, column 2).

$X_7$: Capital per cultivable hectare on private holdings of over five hectares in the form of irrigation works and equipment.

Source: i.q. $X_6$.

$X_8$: Capital per cultivable hectare on *ejido* holdings in the form of machinery, implements, tools, etc.

Source: Ibid. Value of capital in the form of machinery, implements, vehicles, hand tools, and utensils on *ejido* holdings (Table 3, columns 7 and 8) is divided by cultivable area of *ejido* holdings (Table 5, column 2).

$X_9$: Capital per cultivable hectare on private holdings of over five hectares in the form of machinery, implements, tools, etc.

Source: i.q. $X_8$ above.

$X_{10}$: Percentage of total cultivable land in *ejido* holdings.

Source: Ibid. Cultivable land in *ejido* holdings (Table 5, column 2) is divided by total cultivable area for that county (Table 5, column 2).

$X_{11}$: A measure of aridity in 1959 relative to average aridity over a 20 year period.

Source: i.q. $X_{10}$, state level models.

$X_{12}$: $(X_{11})^2$, a measure of the combined effects of extreme relative aridity and wet tropical conditions.

Source: i.q. $X_{11}$, state level models.

$X_{13}$: A measure of average aridity over a 20 year period.

Source: i.q. $X_{12}$, state level models.

$X_{14}$: $(X_{13})^2$, a measure of the combined effects of extreme average aridity and wet tropical conditions.

Source: i.q. $X_{13}$.

$X_{15}$: A measure of labor per cultivable hectare utilized on private holdings of over five hectares in the form of owner labor.

Source: Secretaría de Industria y Comercio. Cuarto censos agrícola. Resúmenes estatales. op. cit. Number of producer and family members employed in private holdings of more than five hectares (Table 10, column 3) is divided by cultivable area of private holdings of more than five hectares (Table 5, column 2).

$X_{16}$: A measure of labor per cultivable hectare utilized on private holdings of over five hectares in the form of sharecrop labor.

Source: Ibid. Number of sharecrop laborers subject to the producer, employed in private holdings of more than five hectares (Table 10, column 4) is divided by cultivable area of private holdings of more than five hectares (Table 5, column 2).

$X_{17}$: A measure of labor per cultivable hectare utilized on private holdings of over five hectares in the form of hired labor.

Source: Ibid. Number of single-day laborers and peons employed on private holdings of more than five hectares (Table 10, column 5) is divided by cultivable area of private holdings of more than five hectares (Table 5, column 2).

$X_{18}$: A measure of labor per cultivable hectare utilized on private holdings of over five hectares in the form of "other labor".

Source: Ibid. Number of employees and workers of other categories employed on private holdings of more than five hectares (Table 10, column 6) is divided by cultivable area of private holdings of more than five hectares (Table 5, column 2).

$X_{19}$: A measure of labor per cultivable hectare utilized on *ejido* holdings in the form of *ejidatario* owner labor.

Source: Ibid. Total number of *ejidatarios*, with and without land employed on *ejido* holdings (Table 10, column 6) is divided by cultivable area of *ejido* holdings (Table 5, column 2).

$X_{20}$: A measure of labor per cultivable hectare utilized on *ejido* holdings in the form of family labor other than owner labor.

Source: Ibid. Family members of *ejidatarios* employed on *ejido* holdings without pay (Table 10, column 10) is divided by cultivable area of *ejido* holdings (Table 5, column 2).

$X_{21}$: A measure of labor per cultivable hectare utilized on *ejido* holdings in the form of hired labor.

Source: Ibid. Number of single-day workers and peons occupied on *ejido* holdings for pay (Table 10, column 11) is divided by cultivable area of *ejido* holdings (Table 5, column 2).

$X_{22}$: Percentage of total cultivable land in private holdings of over five hectares on which fertilizer application was practiced.

Source: Ibid. Cultivable area in private holdings of more than five hectares benefited during the agricultural year with manure, fertilizers and soil conditioners (Table 5, column 12) is divided by cultivable area of private holdings of more than five hectares (Table 5, column 2).

$X_{23}$: Percentage of total cultivable land in *ejido* holdings on which fertilizer application was practiced.

Source: i.q. $X_{22}$.

$X_{24}$: Amount of privately owned land susceptible to cultivation but as yet unopened to cultivation as a percentage of cultivable land in private holdings of over five hectares.

Source: Ibid. Area of private holdings of more than five hectares which could be opened to cultivation in an easy and profitable manner (Table 5, column 13) is divided by cultivable area of private holdings of more than five hectares (Table 5, column 2).

$X_{25}$: Amount of *ejido* land susceptible to cultivation but as yet unopened to cultivation, as a percentage of cultivable land in *ejido* holdings.

Source: i.q. $X_{24}$.

$X_{26}$: A measure of the number of cattle held by *ejidatarios*.

Source: *Ibid*. Number of cattle on *ejido* holdings (Table 9, column 3) is divided by total cultivable and pasture area in *ejido* holdings (Table 5, column 2 and Table 1, column 15).

$X_{27}$: A measure of the number of cattle held by private farmers with holdings of over five hectares.

Source: i.q. $X_{26}$.

# XIV. APPENDIX III--INTERVIEW SCHEDULE

## Interview Schedule[a]

Date:______________________

Name:______________________

Address:___________________

1. Which of the following apply?
   _____Ejidatario
   _____Private property owner
   _____Renter
   _____Partner
   _____Other (Indicate)

2. Draw a map indicating:

   a. location of all fields farmed and owned
   b. for each field include:
      1) field identification number
      2) if owned, rented, managed, etc.
      3) if *ejido* or private property
      4) total number of hectares and number irrigated, seasonal, etc.
      5) number of hectares planted, type of crop, if double cropped, etc.
      6) number of hectares left idle
      7) land quality indications: soil type, topography, land problems such as eroded canals, rocks, etc.
      8) time required to travel from residence to field and usual method of transportation

$\boxed{\text{Residence}}$

[a]Translated from Spanish.

3. Of that area not presently cultivated, how much could be opened to cultivation relatively easily? (Indicate by field number)__________
What would be required to open this land to cultivation?__________
Estimated total cost: $______. Estimated hours of labor:__________
Why have you decided not to cultivate these lands at present?_______
(Repeat for each field where applicable).

4. Of that area not presently cultivated, what portion was previously cultivated? (Indicate field number and number of hectares)________
When was this last cultivated?________________________________
Why was cultivation ceased?__________________________________
Do you plan to cultivate this in the future?____________________
If so, what would be required?_______________________________
Estimated total cost: $______. Estimated hours of labor:__________

5. Of the unproductive lands, why are these unproductive?____________

6. If you are NOT an ejidatario, do you hold "derechos a salvo" in any ejido?_____________If yes, for how long?____________________
Have you ever been an ejidatario?_____. If yes, why not presently?
_______________________________________________________________

7. If you are a private property owner, how did you acquire the property? (Indicate field number and number of hectares for each field where applicable).
_____________Purchase
_____________Inheritance
_____________Other (Indicate)

8. Indicate last year's crop losses where no harvest was undertaken. (Repeat for each field where applicable).
Field identification number_________________________
Type of crop_______________________________________
Area lost__________________________________________
Reason for loss_____________________________________
Number of times reseeded___________________________
Could losses be avoided?_____ How?__________________
Estimated cost______________________________________
Why have you decided not to do this?________________

(Repeat the above for crop losses suffered in previous year).

9. For those fields which are irrigated, indicate for each field:
   Field identification number__________________
   Irrigable area______________________________
   Reasons for any difference in the above two areas________________
   Number of times irrigated (Indicate for each crop)________________
   Is there sufficient water?_____________________
   Could the amount of water be increased?________ How?______________
   In what way(s) has irrigation benefited your farming operations?
   _____Allowed cultivation of previously uncultivated land
   _____Permitted more than one harvest per year
   _____Allowed change in cultivated crops from______to_________
   _____Given increased yields from __________to________________

   Repeat the above information for drainage works.

10. Where irrigation is found, indicate the following:
    Type of irrigation equipment__________________
    Number of hectares benefited__________________
    Year of installation__________________________
    Original cost_________________________________
    Type of ownership (government, collective, etc.) of irrigation works
    ________________________________________________________________

    Repeat the above information for drainage works.

11. Indicate present (or immediate past) cultivation situation. (Repeat for each field).
    Field identification number__________________
    Number of hectares cultivated_________________
    Number of hectares harvested__________________
    Number of hectares double cropped_____________
    Number of hectares idle_______________________
    Why did you leave the land idle?_____________________________

    (Repeat for previous year)

    (Repeat for next year's plans)

12. In those instances where NO land was left idle, why was no land left idle?________________________________________________________

13. Where land WAS left idle, why was the idle portion not rented?_____
    What was the last year in which the idle land was cultivated?______
    Would it be possible to use the land in other ways rather than leaving it idle?__________ How?______________________________
    Why did you prefer to leave it idle?_____________________________

14. When you leave land idle, do you usually leave:

Your entire holding______
Part of the field________
The entire field_________

Do you ever leave the same area idle for two years or more?________
If yes, up to how long?__________Why?______________________________

15. What activities do you perform on the idle land?

_____Pasturing of animals (If yes, indicate number of head, type of animal, number of days or months left)
_____Weeding (If yes, indicate number of times)
_____Plowing
_____Other treatment or use of land (Indicate)

16. Which of the following are serious problems: How are you attempting to solve them?

_____Soil erosion caused by water______________________________
_____Soil erosion caused by wind_______________________________
_____Scarcity of irrigation water______________________________
_____Low soil fertility_________________________________________
_____Other (Indicate)___________________________________________

What do you consider to be the principal problem with your cultivable lands?______________________________________________________

17. Are you familiar with green manure practices?_____ If yes, have you ever planted green manures?_____ If no, why not?________________

Are you familiar with contour farming practices?_____ If yes, have you ever tried them?_____ If no, why not?______________________

18. Do you believe leaving land idle:

_____Increases the amount of water held in the soil?
_____Increases soil fertility?
_____Has other benefits? If yes, indicate what these are__________

19. With your present resources, could you increase the number of hectares which you cultivate?_____ If yes, how many more?_________

What resources most limit an increase in area cultivated above that presently cultivated or indicated above?__________________________

20. If you are an _ejidatario_ or have "_derechos a salvo_", do you feel any laws should be changed so it would be possible to sell, rent, mortgage, etc. the _ejido_ lands?_____ If yes, how?_______________
Why do you favor such a change?_________________________________
What restrictions on any changes would you suggest?_______________

21. Would you prefer that your lands were private property rather than _ejido_ lands?_____ Why?_________________________________________

22. If your _ejido_ holdings were converted to private property:
Would you sell your lands?_____Why?_____________________________
Would you trade your lands?_____Why?____________________________
Would you rent your lands?_____Why?_____________________________
Would you change your farming activities in any way?_____How?______
Would you be willing to pay for such an ownership change?_____ How much?______________________________________________________________

23. Indicate which of the following apply to the type of land title held (if more than one applies, include field identification number):
_____ _Ejidatario_ with clear land title
_____ _Ejidatario_ with lands in provisional form only
_____ _Ejidatario_ with land held in other form (Indicate)
_____Private property with title in order
_____Private property without clear title
_____Holder of _certificados de inafectabilidad_

24. Have you encountered labor shortage problems?_____If yes, what months is labor shortage greatest?_______________How many more men would you have liked to have hired during this time?____________________Have you encountered any other type of labor problems__________________ (Indicate)_________________________________________________________

25. Have you ever worked outside of Mexico?_____If yes, where?_________
For how long?_______________Number of times?__________Type of work done?_________________________Has the work experience influenced your farming operations in any way?_____If yes, how?_______________

26. Have you or any members of your immediate family participated in any off-farm employment_____If yes, complete the following for each person involved:
Relationship________________________________
Age________________________________________
Sex________________________________________
Months worked______________________________
Days worked/month__________________________
Type of work_______________________________
Amount and type of payment____________________

27. How many additional days would you like to have been able to work in agricultural endeavors?__________Would you like or prefer additional non-agricultural employment?_____If yes, what type?_________ Why have you been unable to participate in such employment?________
______________________________________________

28. Indicate level of capital used in farming.

| Type | Original cost | Year purchased |
|---|---|---|
| Machinery: | | |
| | | |
| | | |
| | | |
| Implements: | | |
| | | |
| | | |
| Hand tools: | | |
| | | |
| | | |
| Livestock Equipment: | | |
| | | |
| | | |
| Other: | | |
| | | |
| | | |
| | | |

29. Have you received credit from any source during the last three years? _________ If yes, complete the following for each loan:

Year received: ______________________________
Source of credit: ______________________________
Form of credit (cash, in kind, etc.): ______________
Amount of credit: ______________________________
Length of time of repayment: ____________________
How the loan was used: __________________________
Problems or beneficial results: ________________
Rate of interest paid: __________________________

30. Do you consider the credit extended to you to have been sufficient for your agricultural production needs? _____ If not, why not? _______
__________________________________________________________
How would you apply additional credit if extended? ______________
_________________________ How much additional credit would you like to be able to receive? _____________________ For what activities has credit been especially difficult to obtain? ______________________
Why? ______________________________________________________

31. Have you received any technical advise or help from the lending institution? _____ If yes, in what form? ______________________
Has this been useful? _____ Why? __________________________________

32. If you have NOT received any credit, do you feel that credit would be useful to you in your farming activities? _____ Why? ___________
__________________________________________________________
Have you ever needed credit? _____ Why? ___________________________
Have you ever solicited credit? _____ If no, why not? _____________
_____________________________ What explanation was given for refusing to grant credit? ___________________________________________
What guarantees were required? ___________________ Could you meet these? ____________________ Did you have previous debts pending at the time? ___________________________________________________

33. Do you believe you could get credit at the present time if you needed it? _____ If yes, name of source most likely to grant you the needed credit? ____________________ If no, why do you feel it would not be possible to get credit from any source? ______________________
Are you in a position to mortgage your holdings for credit? ________
If no, why not? ___________________________________________

34. Livestock inventory: Indicate below the number and type of livestock owned.

| | Purebred (#) | Crossbred (#) | Grade (#) |
|---|---|---|---|
| **Cattle:** | | | |
| Bulls over three years | | | |
| Cows over three years | | | |
| Steers and heifers over three years | | | |
| Cattle two to three years | | | |
| Calves under one year | | | |
| **Sheep:** | | | |
| Rams over two years | | | |
| Ewes over two years | | | |
| Rams, weathers and ewes six months to two years | | | |
| Lambs under six months | | | |
| **Swine:** | | | |
| Boars over one year | | | |
| Sows over one year | | | |
| Swine six months to one year | | | |
| Swine under six months | | | |
| **Horses:** | | | |
| Over four years | | | |
| One to four years | | | |
| Colts under one year | | | |
| **Mules:** | | | |
| Over three years | | | |
| Three years and under | | | |
| **Donkeys:** | | | |
| Over two years | | | |
| Two years and under | | | |
| **Goats:** | | | |
| Over six months | | | |
| Under six months | | | |
| **Poultry:** | | | |
| Chicken | | | |
| Turkeys | | | |
| Other | | | |
| **Bee hives:** | | | |
| **Other:** | | | |

35. Crop and pasture activities: (Repeat information for each activity).

Annual crops:
- Type of crop:______________________________
- Number of hectares seeded and month:______________________________
- Number of hectares harvested and month:______________________________
- Production per hectare:______________________________
- Amount used at home; other uses:______________________________
- Price received:______________________________
- Indicate if single, double, companion crop, etc.:______________

Perennial crops:
- Type of crop:______________________________
- Number of hectares planted and year:______________________________
- Number of hectares harvested and month:______________________________
- Production per hectare of mature plants:______________________________
- Amount used at home, other uses:______________________________
- Price received:______________________________
- Indicate if companion crops, etc. were also planted:__________

Pastureland:

| | Natural, plains | Natural, hillside | Artificial, improved |
|---|---|---|---|
| Number of hectares: | | | |
| Type of animal pastured: | | | |
| Number of animals pastured per hectare: | | | |
| What months is pasture used? | | | |
| Total number of days on pasture: | | | |

Other land: (forest, collectivo ejido, etc.)

Indicate use of land, production per hectare, price per unit of product:______________________________________________________

______________________________________________________________

36. Have you in any way tried to improve your native pastures?_____If yes, how?______________________________________________________
Have you in any way tried to improve your livestock?______________
If yes, how? (Indicate below where applicable).
- _____Purchase of improved stock
- _____Use of culling and selection practices
- _____Artificial insemination
- _____Improved feeding rations
- _____Other (Indicate:____________________)

37. Use of modern inputs in cropping activities:

| Type of input | Used last year | Used at some time | Type of crop applied to | Number of hectares treated and quantity per hectare used | Recommended or suggested by | Result |
|---|---|---|---|---|---|---|
| Improved seed | | | | | | |
| New varieties | | | | | | |
| Improved plants | | | | | | |
| Insecticides | | | | | | |
| Fungicides | | | | | | |
| Herbicides | | | | | | |
| Commerical fertilizer | | | | | | |
| Soil conditioners | | | | | | |
| Green manures | | | | | | |
| Other (Indicate) | | | | | | |
| ________________ | | | | | | |
| ________________ | | | | | | |

38. In your agricultural activities, do you consult with any person in particular when important problems or decisions arise?________If yes, with whom?__________What is his position?__________

39. Do you keep any written records of your farming activities?________If yes, what information do you include?______________________________________________________

40. What do you feed your livestock? (Indicate approximate percent of total feed intake).
_____Pasture
_____Hay
_____Grain
_____Post harvest refuse
_____Prepared or balanced rations
_____Silage
_____Other (Indicate:__________________)

41. What disease or health problems have you encountered with your livestock?________________________Have you vaccinated your livestock?_____If yes, against what diseases?__________________________
Have you followed a tick eradication program?_____If yes, in what form?_______________If no, why not?________________________________

42. Social factors: For each member of the household where applicable, indicate:

| | Head of household | Other | Other | Other |
|---|---|---|---|---|
| Age: | | | | |
| Sex: | | | | |
| Years of schooling completed: | | | | |
| Years of schooling expected to be completed: | | | | |
| Level of literacy: | | | | |

(To be answered by head of household) How many years of schooling would you like your sons to complete?__________How many years of schooling would you like your daughters to complete?__________

What type of occupation would you like your sons to undertake?__________
What type of occupation would you like your daughters to undertake?
__________________________

43. Formal leadership positions and responsibilities:

| Name of organization | Position held | When (year) | Number of years a member of the organization |
|---|---|---|---|
| | | | |

44. What do you consider to be the most important problem to be solved in this town?________________________How do you think this problem should be resolved?____________________________________________

45. What do you consider to be the most important problem affecting agricultural production needing attention in this town?____________ What do you feel should (could) be done?__________________________

46. In your opinion, what is needed most to increase agricultural production on your holdings? (Rank by order of importance)
    _____Production credit (Indicate how it would be used:____________)
    _____Technical information
    _____Irrigation
    _____More land
    _____Other (Indicate:_________________________)